



The Chiropractic Vertebral Subluxation Part 2: The Earliest Subluxation Theories From 1902 to 1907

Simon A. Senzon, MA, DC

ABSTRACT

Objective: The purpose of this paper is to review and discuss the history of chiropractic vertebral subluxation (CVS) in the chiropractic profession between the years 1897 and 1907.

Discussion: The first theories in chiropractic were developed by pioneers such as D. D. Palmer; his students, such as A. P. Davis, Oakley Smith, and Solon Langworthy; and his son B. J. Palmer. Their thoughts on CVS established foundational theories for the profession. D. D. Palmer posited his initial concept of CVS as an articular disrelationship between vertebrae causing pressure and impingement on nerves leading to too much or too little function. Palmer's students developed additional theories.

Conclusion: From the first years of CVS, there was a diversity of theories, practices, and scientific rationale. This account of the early theories may offer insights into the historical literature. (J Chiropr Humanit 2018;25C:22-35)

Key indexing terms: *Chiropractic; History*

INTRODUCTION

Several theories about the chiropractic vertebral subluxation (CVS) emerged during the early years of the chiropractic profession. D. D. Palmer, the founder of chiropractic, and his early students, including Andrew P. Davis, Oakley Smith, and Solon Langworthy, and his son B. J. Palmer, published the first books on the topic. Their thoughts on chiropractic and CVS established foundational theories of the profession (Fig 1).

Authors of chiropractic history have attempted to piece together early chiropractic literature on the topic of CVS. However, some of these writings may contain historical errors, especially for materials described from 1902 to 1907. Errors may have a bearing on modern day literature that analyzes the CVS¹⁻³ or on contemporary papers that cite older materials.⁴⁻⁶ Since the publication of some of these histories, additional sources have become available and may help fill in gaps in the literature or update the historical record of the chiropractic profession and its theories with new discoveries, and, perhaps, greater accuracy.

A more accurate historical record of CVS between the years 1897 and 1907 may develop better-informed positions about the history of CVS theory and foster a

more objective foundation for discourse and analysis. History is composed of events interpreted through the perspectives of the present. The more detail conveyed, the less possibility that events and ideas of the past may be misinterpreted. It is valuable for the chiropractic profession to have the most accurate portrayal available of the history of CVS theories because they have heavily influenced the profession since 1902.⁷⁻¹²

Therefore the purpose of this article is to provide a history of the CVS during the years 1897 to 1907 and to offer and appraise scholarly historical literature with an attempt to correct potential errors in previously published papers.

DISCUSSION

D. D. Palmer's first chiropractic students graduated in 1898.¹³ Between 1902 and 1907, several of his students developed and described CVS in their lectures and writings, including B. J. Palmer,¹⁴ Andrew P. Davis,¹⁵ O. G. Smith,¹⁶ and S. L. Langworthy.¹⁷ The theories of these pioneers shaped the discourse for the future of the profession.

The early students of D. D. Palmer are mentioned in the literature; however, their ideas are rarely described in the context of CVS history. Smith, Langworthy, and Paxson's *Modernized Chiropractic* is probably the most well-known writing of these students.¹⁸⁻²⁰ This book emphasized the axis motion between vertebra and the effect on the ligaments of the intervertebral foramina and discs.¹⁷ Davis' approach to chiropractic has limited mention in the literature and yet it influenced several early theories.^{15,21-23} B. J. Palmer's 1907 text contains descriptions of his early theories. Although B. J.'s

School of Health and Human Sciences, Southern Cross University, Lismore, New South Wales, Australia.

Corresponding author: Simon A. Senzon, MA, DC, 218 E. Chestnut Street, Asheville, NC 28801. Tel.: +1 828 251 0815. (e-mail: Simon@institutechiro.com).

Paper submitted May 18, 2016; accepted May 15, 2018.
1556-3499

Copyright © 2018 by National University of Health Sciences.
<https://doi.org/10.1016/j.echu.2018.10.009>

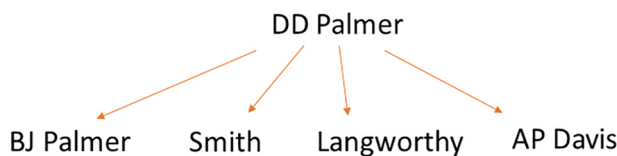


Fig 1. Some of D. D. Palmer's first students.

text was influential in later theory, it is also not well described in the literature.¹⁴ These authors' foundational CVS theories are worth revisiting to more fully describe historical ideas in the chiropractic profession.

THE FIRST USE OF THE TERM *SUBLUXATION*

The first published use of the term *subluxation* in the chiropractic profession is claimed to be an advertisement by O. G. Smith in the *Clarinda Herald* on February 4, 1902,²⁴ and his first use of *intervertebral foramina* (IVF) related to chiropractic in April 1902.¹⁶ Smith was an 1899 graduate of D. D. Palmer's school¹³ and may have read a case report from 1901 in the *Journal of Osteopathy* where an osteopath used the term or a synonym of it.^{16,25} Smith may have been a student of D. D. Palmer for a longer period than any other student because he studied with Palmer in Iowa starting in 1898 and later in California and Chicago in 1904.^{16,26}

Another unreported use was by D. D. Palmer. In a letter to his son dated April 27, 1902, he used "sub-luxation."⁷ B. J. Palmer started using *sub-luxation* in August 1902.^{16,27} Thus it seems that the first use of the terms *subluxation* and

IVF by chiropractic authors was not by Solon Langworthy or his student C. W. Burtch, as has been previously supposed.^{4,28} Another early use of *sub-luxation* by Langworthy was in the July 1902 announcement for his new American School of Chiropractic and Nature Cure,^{16,29} which may be part of an unattributed quote from an advertisement of D. D. Palmer's dated June 14, 1902.³⁰ Fig 2 shows the first known uses of the terms *luxation* and *subluxation* by chiropractic authors.

D. D. PALMER'S THEORIES

D. D. Palmer's writings on healing and his philosophical approaches to "disease" and "dis-ease" date back to 1886 and 1887.^{31,32} In 1887 he wrote, "dis-ease is a condition of not ease, lack of ease."³² This concept became central to Palmer's chiropractic paradigm. As early as 1897, D. D. Palmer proposed his first theories about chiropractic.³³ He suggested that nerves could be stretched, strained, or pinched; that vessels could be compressed; and that taking the strain off of nerves was of vital importance.³³ He writes, "I often find an injury in some part of the human frame caused by a fall, a strain or shock, a partial dislocation or some nerve unduly strained, stretched, pinched, or something wrong which must be righted."³³ He also recommended annual chiropractic checkups.³⁴

As early as 1900, D. D. Palmer described his "philosophy of treatment" or, "... philosophy of our method of treating diseases of all kinds."³⁵ This was related to his nerve tracing methodology. Palmer would later propose that the term *treatment* did not convey his nontherapeutic approach.³⁶ D. D. Palmer's first substantive writings on chiropractic came


Chiropractor	Term	First known use	Publication	Quote
D.D. Palmer	luxation	1900	The Chiropractic	"Childbed fever is always caused by a lumbar luxation during childbirth."
O.G. Smith	sub-luxation	Feb. 4, 1902	Clarinda Herald	"Please bear in mind - do not ever forget: a) Sub-luxations of vertebrae and other bones to occur. b) That all diseases are caused by a pressure upon nerves or blood vessels. c) And hence, that all diseases (nearly all) can be cured by REPLACING THE MISPLACED STRUCTURES, AND RELIEVING THE PRESSURE ON THE NERVES AND BLOOD VESSELS."
D.D. Palmer	sub-luxation	Apr. 27, 1902	Letter to B.J. Palmer	"Where you find the greatest heat, there you will find the sub-luxation causing the inflammation."
B.J. Palmer	sub-luxations	Aug. 15, 1902	Davenport Times	"Chiropractic is the SCIENCE of replacing these sub-luxations (misplacements,) thereby releasing pressures, consequently we remove the causes, and do not treat effects (symptoms)."
Langworthy	sub-luxations	1902 (after Sep.)	ASC Announcement	"That at least 95 percent of all abnormal, deranged nerves are made so by sub-luxations of joints, more especially the spinal column." -quoted without attribution from D.D. Palmer's "Chiropractic Defined."
C.W. Burtch	sub-luxations	Oct 1903	Backbone	"Pressure is found to be caused almost invariably by sub-luxations of the spinal vertebrae."

Fig 2. Early usages of *subluxation* in the chiropractic profession.

Next Class Matriculates April 1st, 1905

The Palmer School and Infirmary of Chiropractic...
("KI-RO-PRAK-TIK.")

"CHIROPRACTIC'S FOUNTAIN HEAD"



D. D. PALMER, Discoverer and Developer.
PRESIDENT.

Send for "SCHOOL ANNOUNCEMENT" and subscribe for
"THE CHIROPRACTOR," the monthly journal of Chiropractic,
50 cents a year.

Add-ess....

B. J. PALMER, D. C.,
Davenport, Iowa, U. S. A.

Fig 3. Palmer's advertisement for the school in 1905. (Courtesy Special Services, Palmer College of Chiropractic.)

in 1902, the year he started using the term *luxations* to describe a cause of dis-ease.³⁷ Palmer described how the spinous processes were used as handles or levers. He wrote of spinal nerves, foramina, and nerve irritation and focused on nerve pressure and the art of chiropractic. He wrote that by relieving pressure, nature or innate intelligence could perform normal functions.^{30,38} Palmer hypothesized that luxations led to interference with function.³⁸ The concept of interference to transmission of the nerve signal was probably introduced by his son B. J. Palmer.¹⁴ D. D. Palmer wrote years later that transmission of motion and sensation impulses could be disarranged by displacements.³⁹

By 1903 D. D. Palmer hypothesized that 95% of all diseases were from luxations, which caused deranged nerves.³⁸ Palmer purported that when nerves were free to act naturally, the life force would be normal and unobstructed and the

CHIROPRACTIC BOOK.

We have had so many urgent demands for a book on Chiropractic that we at last offer to the public a work, "The Science of Chiropractic." It contains 200 pages, is well bound, and contains much on this new science. It is the only one which explains vertebral luxations, and what we mean by replacing them.

Is used as text book and is the only complete work dealing exclusively on Chiropractic. Is the recognized authority, principles advocated are standard and endorsed by all Chiropractors who use pure and unadulterated Chiropractic.

\$5.00 a copy. If sent by mail, add 25 cents for postage.

Fig 4. Palmer's advertisement for the first chiropractic textbook in February 1906. (Courtesy Special Services, Palmer College of Chiropractic.)

body would be free of pain, aches, and symptoms.³⁸ Also in 1903, D. D. Palmer more fully developed his concepts of innate intelligence, subluxation, and abnormal function.³⁸ He suggested that innate intelligence controlled the vital functions of the body and that it operated through the nerves. Palmer proposed his hypothesis that subluxated vertebra caused pinched nerves, which led to abnormal functions, which were either excess function or insufficient.³⁸

Between 1904 and 1906, D. D. Palmer elaborated on his theories and developed his practice. His theories were based on his studies and clinical observations.^{13,40} During this time, he was living in Davenport, Iowa, teaching students, running a clinic, and writing monthly articles in *The Chiropractor* (Fig 3).¹³ In February 1906, D. D. and B. J. Palmer advertised that a book was being created (Fig 4).⁴¹ Several months after this advertisement, B. J. Palmer took over the school in the spring of 1906¹³ and published the book *The Science of Chiropractic* later that fall.⁴² *The Science of Chiropractic* included D. D. Palmer's articles along with other essays from *The Chiropractor*.⁴²⁻⁴⁵ In this collection of writings, D. D. Palmer suggested that the principles of chiropractic were founded on anatomy, pathology, physiology, and nerve tracing, which, along with observation and palpation, were his methods of analysis.⁴² He also proposed that CVS could occur throughout an individual's lifespan and that it related not only to physiological but also to psychological disease processes. His claim was that the cause of disease was an intelligible and disordered condition in the body caused by the material derangement of nerves.⁴²

In 1904 D. D. Palmer postulated that subluxated vertebrae affected the nerves and caused pressure because the nerves were pinched at the foramen.⁴³ By 1909 he used *impingement* rather than *pinched*, and claimed that was what he meant all along.⁴⁶ According to Palmer, *pinched*, as it was being used by other chiropractors, was incorrect. He felt that *pinched* referred to pressure on both sides of a nerve, causing a blockage, whereas *impinged* referred to the nerve being pressed on from one side or stretched and modified, instead of being blocked.⁴⁷

The phrase “bone out of place” has sometimes been attributed to D. D. Palmer; however, this may be an inaccurate depiction of his view. It is possible this led to misinterpretations of D. D. Palmer’s definition of CVS by limiting his theory to one that is a bone out of place.⁴⁸⁻⁵¹ As early as 1905, D. D. Palmer described a “chiropractic luxation” as “a partial separation of two articular surfaces.”⁵² In 1906 he wrote of “sub-luxation known to the Chiropractor as a displacement of the articular processes,” and “a chiropractic luxation being a partial dislocation, or what we are pleased to term sub-luxations.”⁴² In 1910 he wrote that a subluxation was “a displacement of two or more bones whose articular surfaces have lost, wholly or in part, their natural connection.”³⁶ He also wrote that “sub-luxation is a partial or incomplete separation; one in which the articulating surfaces remain in partial contact,” and that “a sub-luxation consists of two or more bones, whose articular surfaces have lost in part their natural connection—one in which the articulating surfaces remain in partial contact—those which partly preserve their connection.”³⁶ This is further evidence that D. D. Palmer felt that CVS was associated with a joint, not one isolated bone.

D. D. Palmer wrote an article in February 1906 distinguishing the difference between the “osteopathic lesion” and the chiropractic subluxation.⁴⁴ He wrote, “The lesion theory of the Osteopaths, is not that of sub-luxation of the Chiropractor.”⁴⁴ He viewed the lesion as an effect and sub-luxation as a cause. He also suggested that *lesion* was a general term and that it could mean anything, which made it useless when trying to convey his definition of CVS. This article was republished in *The Science of Chiropractic in 1906*.⁴² Other articles by D. D. Palmer highlighted his distinction that his CVS theory emphasized the nervous system and that osteopathic theory emphasized obstruction to the circulatory system.³⁶

B. J. PALMER’S THEORIES

The earliest printed evidence of the use of *subluxation* by B. J. Palmer was on August 31, 1902.²⁷ He introduced the word into advertisements based on D. D. Palmer’s articles. B. J. Palmer continued to spread use of the term through his advertising until 1904 when he became assistant editor of *The Chiropractor*.⁴³ B. J. served under his father in this capacity because D. D. Palmer was the editor.¹³ Some of the chapters from their book appear to have been written or compiled by B. J. directly.⁴²

Between 1906 and 1909, B. J. developed thousands of stereopticon slides for his lectures.¹³ After requests of a transcription of his lectures in 1906, all subsequent lectures were recorded or transcribed.¹⁴ In each lecture series he developed his CVS theories further. By 1909, B. J. claimed that his open clinic was seeing 180 to 200 patients per day.⁵⁴ B. J. reportedly used these cases to refine and develop his

chiropractic models. His early ideas were inspired by his lectures and the growing clinic.⁵⁵

B. J. Palmer’s lectures from February and March, 1907, were copyrighted and published as *The Science of Chiropractic: Eleven Physiological Lectures*, volume 2.⁵⁶ In this book, B. J. described the “cycle of life,”¹⁴ which was one of his most enduring contributions to CVS theory because it included his theory of interference to transmission of nerve impulses. The cycle consisted of a triune, consisting of the *creation* (C) of mental impulses, *transmission* (T) of impulses along nerves, and *expression* (E) of function in the tissue cell. What I refer to as the CTE cycle, includes the afferent side of the nervous system; an impression of vibrations from the environment, afferent transmission to the brain, and interpretation of the stimuli by the inherent intelligence. His theory was that the CVS was like a circuit breaker between currents. Chiropractic vertebral subluxation could interfere with the transmission or quantity and quality of impulses.¹⁴

It is possible that B. J.’s CTE cycle was inspired by his study of the French neurologist, H. P. Morat, having referenced Morat’s textbook in 1909 and for decades thereafter.^{54,57} In doing so he does not credit Morat but he acknowledges the similarity in their thinking. According to B. J., both were seeking the “missing link” uniting intelligence and matter in the nervous system. B. J. claimed that his cycle of life was the first to make this link in human intellectual history.¹⁴

B. J. Palmer’s thoughts from 1906 and 1907 shaped his chiropractic theories and his self-perceived role in chiropractic for the remainder of his life.¹⁴ It was during this period that he started referring to himself as chiropractic’s “developer.” Reading B. J.’s lectures from this time makes it evident that he felt the development of the cycle of life was the reason for this new designation.¹⁴

The new self-appellation “developer” did not go unnoticed by D. D. Palmer. In January 1909, while living and teaching in Portland, Oregon, D. D. Palmer decided to trace the exact month when his son started referring to himself as the “developer” of chiropractic.⁵⁸ D. D. found that by studying monthly issues of *The Chiropractor*, by then published by B. J. in Davenport, D. D. revealed that the first use was in an advertisement published in the August/September 1907 issue of *The Chiropractor*.⁵⁹ The advertisement was for B. J.’s forthcoming *The Philosophy and Principles of Chiropractic Adjustments: A Series of Twenty-Four Lectures*, volume 3.⁶⁰ D. D. was not pleased with the new designation.

In the biography of B. J. Palmer, *B. J. of Davenport: The Early Years of Chiropractic*, attribution for the appellation *developer* is suggested to be a result of marketing, family disputes, and ego.⁶¹ However, in the biography there are few quotes or analyses from B. J.’s books.⁶¹ Thus the text unfortunately does not necessarily capture the full extent to which B. J. Palmer was using the term *developer*. By studying transcriptions of his lectures, B. J.’s thoughts and motivations on the topic may become more apparent. My

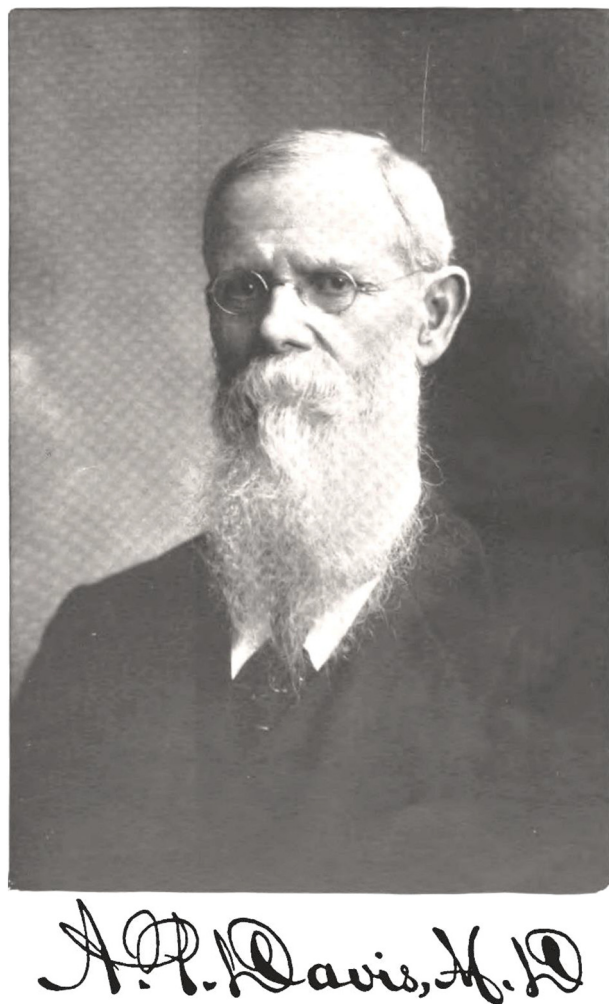


Fig 5. A. P. Davis circa 1909.

review of the first editions of B. J. Palmer's first 5 books lead me to suggest that B. J.'s expansion about CVS was the main driver of his actions, teachings, and writings during this time and for decades thereafter.^{14,54,60,62,63}

OTHER EARLY PALMER GRADUATES THEORIES

A. P. Davis was a 1894 graduate of A. T. Still's school of osteopathy and an 1898 graduate of D. D. Palmer's school (Fig 5).²² Davis developed his method of *Neuropathy* and published 2 books on his methods, in 1905 and 1909.^{15,64} His 1905 book is the first to purport to teach chiropractic.¹⁵ Davis claimed that the neurological component of CVS was secondary to the circulatory obstruction. As such, his perspective disagreed with Palmer's model. To Davis, the adjustment was a stimulus, which united the positive and negative forces and neutralized the acid/alkaline balance.⁶⁵ D. D. Palmer strongly disagreed with Davis' theories.³⁶

Gaucher-Peslherbe suggested that D. D. Palmer's inspiration to start writing journal articles and a book in 1905 was to refute Davis and define his own ideas in published works.²³

Smith, Langworthy, and Paxson's *Modernized Chiropractic* was published in 1906, with Smith as the primary author, Langworthy the publisher, and Paxson the editor.^{17,66} A recent historical discovery of the original handwritten manuscript of the book suggests that Smith wrote most or all of the book.¹⁶ All 3 authors earned their chiropractic degrees from D. D. Palmer in 1899, 1901, and 1903, respectively, and they were all involved with the American School of Chiropractic in Cedar Rapids, Iowa, in 1904.¹⁶ The "subluxation" was described in the text *Modernized Chiropractic* as an aberrant motion and not merely a misalignment of the articular surfaces.¹⁷ This concept was central to Palmer's theory.⁴² The objective of the thrust in an adjustment was to change the field of motion toward the hub where it "belongs."²⁰ They suggested that this would lead to spontaneity and that spontaneity was a release of energy or "subtle force" in the muscles and ligaments. They theorized that this activation and arousal of the body's inherent powers contributed to the body's self-preservation and recuperation.¹⁷ *Modernized Chiropractic* used the term *subluxation* 1186 times.¹⁷ In contrast, the Palmers' first book only used the term 48 times and *luxation* 155 times⁴² (Fig 6).

It is proposed that Oakley Smith was the first chiropractor to write about descriptions seen in the laboratory on the CVS. Under a microscope, as early as 1905, Smith found that scar tissue and shrunken tissue of the ligaments in the intervertebral disc and foramina affected the nerves and other structures.¹⁶ This led to the founding of his own profession, which he called *naprapathy*. Smith reissued *Modernized Chiropractic* in 1932, with a new introduction and title. It was called *Naprapathic Genetics*.⁶⁶ Smith suggested the reader substitute every instance of *subluxation* in the book with the term *ligatite*, which was a term he coined in 1905.⁶⁶ Tight ligaments, he surmised, led to nerve pressure.⁶⁷ Smith conducted and supported the first chiropractic anatomical research into the IVF to explore this hypothesis.^{68,69} In 1913 he developed his connective tissue doctrine.⁶⁷

CRITICAL REVIEW AND DISCUSSION OF PREVIOUS WORKS

The earliest theories of chiropractic represent the foundational development of the profession's theoretical, scientific, and philosophical rationale (Fig 7). Further analysis and an enhanced understanding of the core theories from this era may allow the modern chiropractor to more accurately interpret the literature, develop nuanced distinctions about these early ideas, and measure early theory against current insights from neurophysiology materials and other research. The following critical review explores previously published literature with an emphasis on challenging accuracy of statements and content in previously published works, updating historical timelines,



Read from left to right. Name and date of graduation at The Palmer School of Chiropractic. O. G. Smith, 1899. E. E. Sutton, 1901. "Old Chiro," discoverer and developer of Chiropractic. B. J. Palmer, 1902. O. B. Jones, 1900. T. H. Storey, 1901. S. M. Langworthy, 1901.

Fig 6. Read from left to right with graduation year from the Palmer School of Chiropractic. O. G. Smith, 1899; E. E. Sutton, 1901; D. D. Palmer; B. J. Palmer, 1902; O. B. Jones, 1900; T. H. Storey, 1901; S. M. Langworthy, 1901. Photo taken in January 1902 and printed in *The Chiropractor*, vol. 1, no. 3, p. 21, 1905. (Courtesy Special Services, Palmer College of Chiropractic.)

and pointing out theoretical ideas that continue to be described in the literature.

Assumptions in the Literature About D. D. Palmer's Knowledge

This author posits that there should be trepidation about how previous articles may have depicted the history of ideas in early chiropractic. For example, in 2005 Nelson et al¹ developed a series of "postulates" from D. D. Palmer's theories and philosophical explanations in an attempt to offer a new rationale for the profession. In relation to D. D. Palmer's adjustment of Harvey Lillard in 1895, they wrote¹:

D.D. Palmer might state that he was trying to explain why a deaf man with a vertebral misalignment recovered his hearing following re-alignment of that vertebra. However, there is no evidence that Palmer undertook any sort of systematic exploration of the

spine/health relationship following his epiphany. What we know about D.D. Palmer suggests that patient and disciplined observation was not his forte. His method of discovery was by inspiration and revelation.

However, Palmer writes of his reasoning process after comparing the Lillard case to a heart case³⁶:

Shortly after this relief from deafness, I had a case of heart trouble which was not improving. I examined the spine and found a displaced vertebra pressing against the nerves which innervate the heart. I adjusted the vertebra and gave immediate relief—nothing "accidental" or "crude" about this. Then I began to reason if two diseases, so dissimilar as deafness heart trouble, came from impingement, a pressure on nerves, were not other disease due to a similar cause, Thus the science (knowledge) and art

Chiropractor:	Subluxation Theory
D.D. Palmer	<ul style="list-style-type: none"> • Subluxation is a partial displacement of the articular surfaces causing impingement, which leads to pressure on nerves and abnormal function of body systems.
B.J. Palmer	<ul style="list-style-type: none"> • Subluxation produces partial pressure on the nerves emitting from the spinal foramina hindering the quality and quantity of conduction of brain impulses to tissues for expression.
O.G. Smith	<ul style="list-style-type: none"> • Subluxation is caused by tight ligaments or ligatites, which leads to nerve pressure at the intervertebral foramina.
Smith and Langworthy	<ul style="list-style-type: none"> • Subluxation is an aberrant motion of the vertebra leading to nerve pressure.
Davis	<ul style="list-style-type: none"> • Subluxation causes circulatory obstruction and then nerve obstruction, which leads to an imbalance of positive and negative forces causing acid/alkaline imbalance.

Fig 7. First subluxation theories that emerged during this time.

(adjusting) of Chiropractic were formed at that time. I then began a systematic investigation for the cause of all diseases and have been amply rewarded.

There is evidence of Palmer's systematic exploration of the spine and health. D. D. Palmer's earliest study of anatomy and physiology in relation to health and the spine goes back to the late 1880s and early 1890s.^{32,70,71} He wrote of obstruction to vessels in 1892.⁷⁰ He cared for patients for a decade before he first adjusted Lillard.⁷² His patient care during those years included a systematic approach to determining locations of organ congestion through a history and presentation followed by palpation of tender spots over affected organs.⁷³ This was an innovation on the standard magnetic healing practices of his time⁷³ (Fig 8). Palmer then decided that the problems he had been treating were connected to the spine through nerve and circulatory pathways. This was assessed by palpation of tender nerves to the source of injury in the spine, which he termed *sub-luxation*.^{30,33,35,74}

An analysis of D. D. Palmer's study of anatomy, physiology, and surgery textbooks up to 1910 suggests that he was at least as well read as the average medical doctor and that he cited the latest editions in addition to historical editions going back 200 years.^{75,76} Photographs of his medical library and osteology collection were published in 1906.⁴² Palmer wrote of the effects of impingement on recurrent meningeal nerves in relation to their innervation of the meninges.³⁶ About D. D. Palmer, Nelson et al¹ state, "His method of discovery was by inspiration and revelation." However, this does not necessarily reflect an accurate historical record.

Another fascinating and confusing element of D. D. Palmer's studies is his claim that he received chiropractic from a spirit who was a doctor that lived 50 years earlier, named Jim Atkinson.³⁶ D. D. Palmer seems to have made this claim in hopes of offering legal cover to chiropractors.⁷⁷ One recent historical discovery suggests that he was considering such a maneuver as early as 1904.¹⁶ However, that claim does not minimize the decades of self-study and clinical practice that led to his systematic exploration of the spine, nervous system, and physiology.^{23,77-80} D. D. Palmer's claim to receiving information about chiropractic from an

"intelligent spiritual being" named Jim Atkinson was linked to Spiritualism,⁷⁷ of which Palmer was an adherent. Years later, B. J. suggested that Spiritualism should be considered D. D. Palmer's religion.⁸¹ D. D. Palmer believed in spirit communication and even suggested that his entire 1910 text was written as a form of "revelation."^{77,82} Considering that much of that book was written over the course of 2 years, we might consider it today a type of "flow state" writing style.⁸³ It was common practice for Spiritualist authors of books on health topics to make claims that the information came from the spirits of doctors from other eras.⁸⁴ It is possible that D. D. Palmer was modeling the approach based on one of the books in his library by Stone. Stone claimed that his book *The New Gospel of Health*⁸⁵ was written by his spirit, which was in communion with disembodied physicians such as Sir Astley Cooper and Sir Benjamin Brodie, "who had stood at the head of their profession when in earth-life."⁸⁵ Palmer's copy of Stone's book was signed by him on August 6, 1888, and is in the Palmer museum. We will never accurately know why D. D. Palmer claimed to have received chiropractic from a spirit; however, it seems that Spiritualism was a guiding element in his reasoning. There can be several interpretations of these historical data.

Historical scholarship about D.D. Palmer has been guided by Keating's work on the evolution of Palmer's ideas and by Lerner's writing on the earliest use of philosophy and terminology in chiropractic.^{4,6} Some of Keating's research on D. D. Palmer's early ideas was based on original documents which are in the Palmer archives.⁶ Keating compared those documents to quotes from Palmer's later writings in an article on the evolution of Palmer's ideas.⁶ Keating's basic argument was that D. D. Palmer's ideas were not static but went through 3 distinct phases of development: 1897 to 1902, 1903 to 1906, and 1908 to 1910.⁶ Although I feel that many of Keating's observations from his *The Evolution of Palmer's Metaphors and Hypotheses*⁶ are valid, there are additional interpretations of Palmer's writings.

D. D. Palmer's writings from 1872 to 1913 are available in searchable portable document files, digital books, journals, and newspaper archives.^{31,72,86-88} From these, we can add to previous historical papers and provide



DR. PALMER

— THE —

Magnetic Healer

— CURE —

*Brain Fever, Lung Fever, Ague,
Rheumatism, Neuralgia, Sprains
and Diseases of the Heart.*

RYAN BLOCK, - DAVENPORT, IOWA

Fig 8. Advertisement in the Davenport Times, October 29, 1891.

additional perspectives on the topics studied by the authors of these papers. For example, Keating's paper is an excellent example because he traced several important theories of D.D. Palmer's. We can address each concept to

determine what new information might be added to Keating's analysis.

Keating made the case that D. D. Palmer's use of the term *tone* was first represented as "vital tone" in his 1897 writings and was present in his writings until 1902 but then absent in his writings until 1908. However, we now know that Palmer used "healthy tone" even earlier, in 1896,⁷³ and in his 1906 book,⁴² where he writes, "Freeing these nerves allows them to act and innervates the vital parts; improve digestion, assimilation and the circulation, giving strength, vigor and tone to the mental and physical..." Thus gaps in on this topic can be filled in with new knowledge on this topic. Rather than *tone* representing distinct new ideas for Palmer during different periods and acting as a bridge between his older ideas and his newer ones,⁶ it was a concept that gradually developed over time. I suggest that *tone* came to characterize all disorders and disturbances especially related to the "neuroskeleton" or tension frame.^{6,14,23,77}

Other important concepts emphasized by Keating were impingement and nerve-stretching. Keating included little about D. D. Palmer's use of the terms impingement and nerve-stretching. Perhaps this was because materials were not available. New findings in D.D. Palmer's writing suggest Palmer's theory of nerve-stretching was developed from 1897 to 1913 and his theory of impingement was central to his theory from 1905 and features prominently in his 1906 text.^{74,77,89} Impingement, as described by D. D. Palmer in 1910, was not a new development but rather a new distinction of a theory that was in development for years.^{6,36,47} Bovine observed that Palmer's theory focused on the opening of the IVF rather than a closing of the IVF, as proposed by others such as Smith, Langworthy, and B. J. Palmer.⁸⁸ Bovine's observation provides further insight, which adds to a richer understanding of D. D. Palmer's impingement theory.

Keating also suggested that B. J. Palmer and others used the terms *pinched* and not *impinged*.⁶ This interpretation was potentially based in part on Keating's reading of D. D. Palmer's vehemence against other theories.⁴⁶ However, investigation of additional primary literature indicates that *impingement* was a term used by B. J. Palmer and many of his students for decades.^{14,90-95}

Bovine observed that Palmer's theory focused on the opening of the IVF rather than a closing of the IVF, as proposed by others such as Smith, Langworthy, and B. J. Palmer.⁸⁸ Bovine's observation provides further insight, which adds to a richer understanding of D. D. Palmer's impingement theory. Based on materials he had access to at the time, Keating wrote that the term *adjust* was not used before 1903 and suggested that D. D. Palmer did not refer to "intelligence" in spiritual terms until his later writings.⁶ However, documents suggest that D. D. Palmer used the term *adjust* several times between 1897 and 1900,^{33,35,74} and his first reference to "intelligence" as spirit dates to 1872.⁹⁶

Concept:	1872-1886	1887-1896	1897-1902	1903-1906	1908-1910	1911-1914
Tone		"healthy tone"	"vital tone"	Yes	Yes	Neuroskeleton
impingement			Yes	Yes	Yes	Yes
Adjust		Yes	Yes	Yes	Yes	Yes
Intelligence	Yes	?	Yes	Yes	Yes	Yes
Dis-ease/not-at-ease		Yes	Yes	Yes	Disease	Disease
Subluxation			Yes	Yes	Yes	Yes

Fig 9. D. D. Palmer's terminology timeline.

Even though there are gaps in Keating's historical facts, his insights about D. D. Palmer's theories are important. Keating writes, "Ironically, much that is potentially testable in Palmer's theories has been forgotten by chiropractors. Langworthy's and subsequently B. J. Palmer's metaphor of 'pressure on the hose' has replaced Old Dad Chiro's belief in vibrational nerve transmission, aggravated nerve tension and altered tone."⁶ Although it may be true that chiropractors today have forgotten D. D. Palmer's theories, many CVS theorists cited D. D. Palmer and attempted to substantiate his theories.^{54,97-103}

Also, few historians have written about B. J. Palmer's early theories and assessed the impact those theories had on the profession.^{14,60} For example, B. J. Palmer was probably the first to use the hose metaphor to depict the compression theory.⁵⁷ Also, B. J. Palmer developed his own vibrational theory of nerve transmission, which was distinct from his father's theory.^{36,54}

This correction of the timeline of D. D. Palmer's ideas is relevant and important today because earlier analysis of Palmer's theories is well cited in the literature and published in several textbooks (Fig 9).¹⁰⁴⁻¹¹² For example, in an article by Perle where he cited Keating's timeline of D. D. Palmer's ideas,³ Perle relies, in part, on Keating's timeline to disparage chiropractor's use of CVS theories that originated with Palmer. Perle states, "If D. D. could change his theory three times, then why on earth would the chiropractic profession want to pick one of D. D.'s or his son's theories and etch them in stone?" I suggest that the general premise of the argument is incorrect because chiropractors considerably changed and evolved many theories that date back to D. D. Palmer's era. Perle's argument seems to rest on the partial timeline established by a previous publication.⁶

Cyrus Lerner's account of early chiropractic history cites interviews, which are lost to history, as well as court records and newspapers.⁴ Lerner wrote his report in the form of a fictional play. He embellished on facts, some of which could not be verified whereas others have been verified by

historians.^{13,113,114} Lerner's report about the early ideas in chiropractic has been extensively cited and has thus shaped the knowledge base of the profession.^{5,6,19,48,49,112,115-120} Lerner's report led to assumptions about early CVS theories especially in relation to the importance of Langworthy.⁴ Lerner proposed that "subluxation" and "intervertebral foramina" were first used and published by Langworthy in 1903²⁸ and that the text he coauthored introduced philosophy into chiropractic in 1906.¹⁷ These assumptions are likely incorrect, based on currently available historical documents.^{5,7,8,16,30,121-123} Philosophy and CVS were in development before 1906, which counters Lerner's conclusions that philosophy and CVS were invented by Langworthy and solely adopted for legal reasons.^{4,5}

BONE OUT OF PLACE AND LESION CONCEPTS IN THE LITERATURE

In an article in the first issue of *Chiropractic History* on the structural approach in chiropractic,¹²⁴ Rosenthal attributed the "bone out of place" (BOOP) theory to the Palmers because they did not emphasize adjusting multiple CVSs throughout the spine as Carver did. This attribution of the BOOP theory to D. D. Palmer conflates Palmer's analysis, adjusting method, and CVS theory. This has led to confusion in the literature because it did not emphasize Palmer's definition of CVS in terms of the disrelationship of articulations of the joint. His analysis included a 3-finger gliding palpation coupled to nerve tracing to a particular vertebra. His adjusting method involved a thrust on the spinous processes and transverse processes on one vertebra as a lever, although he defined the "subluxation" in terms of a joint, not a bone.^{36,42,77}

Chiropractic historians and theorists have cited Rosenthal's conclusion, which I feel is in error. Moore cited Rosenthal and attributed the BOOP theory to D. D. Palmer.⁷⁰ Wardwell also cited Rosenthal, attributing the BOOP theory to B. J.

Palmer.^{48,49} The first editions of Leach's text on chiropractic theories attributes BOOP to D. D. Palmer without recognizing Palmer's emphasis on the joint because Leach suggested the joint emphasis was a recent phenomenon.^{125,126} Chiropractors of the 1950s and 1960s included D. D. Palmer's models in their joint proprioception hypotheses of CVS.^{97,98,127} Differentiating CVS theory, chiropractic analysis, and adjusting method may aid us to more accurately interpret the history of this terminology in chiropractic and provide more robust materials for discussions regarding the CVS.

Another important distinction about D. D. Palmer's theories that applies to the modern literature was his dismissal of the term *lesion*. Palmer felt that lesions were general and may have been caused by subluxation, but they were not synonymous. To the best of this author's knowledge, there is no known CVS literature that refers to subluxation as a lesion and also references D. D. Palmer's hypothesis on the topic. Authors have used *lesion* as a synonym for *subluxation* in chiropractic without referencing Palmer's disagreement with using that term.¹²⁷⁻¹³⁰ For example, "manipulable spinal lesion" was used by Schafer in the American Chiropractic Association's 1973 CVS definition: "A manipulable spinal lesion ...[has] the following characteristics: vertebral malposition, abnormal vertebral motion, lack of joint play, palpable soft tissue changes, and muscle contraction or imbalance."¹³¹ Cooperstein and Gleberzon suggest that "adjustable lesion"¹³² is more appropriate for the profession because it fits better with the chiropractic paradigm. None of these authors addressed D. D. Palmer's semantics, which defined his paradigm.¹³³ Without reference to D. D. Palmer's reasoning as to why *lesion* was not the correct term, any modern semantic approach using the term may lead to conclusions that may be out of historical context.

DIFFERENT SCHOOLS OF THOUGHT

It is difficult to assess the impact of the other CVS theorists from this period. Zarbuck documented the influence of ideas from Davis' books and *Modernized Chiropractic* on the works of Howard.²⁶ The ideas of Smith, Langworthy, and Davis are also evident in the works of Gregory,¹³⁴ Loban,¹³⁵ Forster,¹³⁶ and Carver,¹³⁷ and thus chiropractors who came after them. A recent article by Coleman et al¹³⁸ assessed the impact of *Modernized Chiropractic* on modern practice. These early texts included overlapping ideas and distinct theories.

Theorists who may not use the language of the Palmers may have been describing the same basic theories. This is an important distinction because the literature often views CVS and Palmer terminology like *mental impulse* and *innate intelligence* as synonymous when there were several models and not all included the same terminology.¹³⁹

In his later years B. J. Palmer insisted that any definition of CVS must include the "mental impulse."¹⁴⁰ Mental impulse,

from this perspective, was analogous to the energy and organizing information traveling over the nerve.¹⁴¹ Some authors from the Palmer school made this distinction a point of definition for CVS and others dismissed it.¹⁴¹⁻¹⁴³ Also, CVS theorists who learned chiropractic between the years 1908 and 1915, such as Drain, Ratledge, and Firth, went on to lead schools and develop their own terminology to capture the same ideas,^{94,112,92,144} as did their students such as Harper, Smallie, Higley, Muller, and Watkins.^{97,98,102,145,146}

A common understanding of the history of ideas offers new insights into the ubiquity of CVS across early theory. It also highlights the importance of teacher-student relationships within chiropractic and dispels thoughts that CVS concepts only came from one school or one school of thought. I suggest that nearly every early chiropractic school was involved in defining and explaining CVS theories.

Limitations

This article reflects one person's interpretation of historical writings and theories. Future reviews of the literature should include more systematic methods. Without detailed search parameters, inclusion and exclusion criteria, synthesis methods, a standard critical appraisal of the literature reviewed, and evaluation of bias, it is acknowledged that conclusions do need to be made with caution. A strength of this work is that it includes new insights into the history of the CVS, based on primary and secondary sources, many of which have not been included in previous works. However, this research is limited by the writings that are currently available. It is likely that historians will find more data in the future. These discoveries will hopefully further detail the history of seminal CVS theories and may alter our understanding of these concepts.

CONCLUSIONS

The term *subluxation* had several different meanings during the period from 1902 to 1907. Yet simultaneously it represented a fundamental concept for early chiropractors. This is one of the paradoxes of the history of the CVS. Each new definition multiplied the complexity of the subject. By understanding that even at this early stage of the profession's development CVS was described in several different theories from different schools calls into question assertions in the literature that CVS was only a Palmer phenomenon or that it was only comprised of one set of ideas. New discoveries of historic documents provide an opportunity to fill in gaps in our knowledge of CVS history and theory and correct inaccuracies that may have been published in the past. This enriched view of the development of CVS theory allows for new and more informed ways to examine the recent literature, understand the past, and apply CVS models to clinical practice.

ACKNOWLEDGMENTS

The author acknowledges Brian McAulay, DC, PhD, David Russell, DC, Stevan Walton, DC, Timothy J. Faulkner, DC, Joseph Foley, DC, and the Tom and Mae Bahan Library at Sherman College of Chiropractic for their assistance.

FUNDING SOURCES AND CONFLICTS OF INTEREST

The author received funding from the Association for Reorganizational Healing Practice and the International Chiropractic Pediatric Association for writing this series of papers. No conflicts of interest were reported for this study.

CONTRIBUTORSHIP

Concept development (provided idea for the research): S.A.S.
Design (planned the methods to generate the results): S.A.S.
Supervision (provided oversight, responsible for organization and implementation, writing of the manuscript): S.A.S.
Data collection/processing (responsible for experiments, patient management, organization, or reporting data): S.A.S.
Analysis/interpretation (responsible for statistical analysis, evaluation, and presentation of the results): S.A.S.
Literature search (performed the literature search): S.A.S.
Writing (responsible for writing a substantive part of the manuscript): S.A.S.
Critical review (revised manuscript for intellectual content, this does not relate to spelling and grammar checking): S.A.S.

Practical Applications

- This series of articles provides an interpretation of the history and development of chiropractic vertebral subluxation theories.
- This series aims to assist modern chiropractors to interpret the literature and develop new research plans.

REFERENCES

- Nelson C, Lawrence D, Triano J, et al. Chiropractic as spine care: a model for the profession. *Chiropr Man Ther*. 2005;13(1):9.
- Huijbregts P. The chiropractic subluxation: implications for manual medicine. *J Man Phys Ther*. 2005;13(3):139-141.
- Perle S. Foundation for Anachronistic Chiropractic Pseudo-Religion. N Y State Chiropr Assoc Newsletter; 2012; August:11.
- Lerner C. *The Lerner Report*. Davenport, IA: Palmer College Archives; 1952.
- Rehm W. Legally defensible: chiropractic in the courtroom and after, 1907. *Chiropr Hist*. 1986;6:51-55.
- Keating J. The evolution of Palmer's metaphors and hypotheses. *Philos Constr Chiropr Prof*. 1992;2(1):9-19.
- Palmer DD. Letter to B.J. Palmer; April 27, 1902. In: Faulkner T. *The Chiropractor's Protégé: The Untold Story of Oakley G. Smith's Journey with D.D. Palmer in Chiropractic's Founding Years*. Rock Island, IL: Association for the History of Chiropractic; 2017:103.
- Smith OG. Advertisement. In: Faulkner T. *The Chiropractor's Protégé: The Untold Story of Oakley G. Smith's Journey with D.D. Palmer in Chiropractic's Founding Years*. Rock Island, IL: Association for the History of Chiropractic; 2017:72.
- DeJarnette MB. The chiropractic subluxation. *ACA J Chiropr*. 1965;2(6):8-11.
- Nelson C. The subluxation question. *J Chiropr Humanit*. 1997;7:46-55.
- Haavik-Taylor H, Holt K, Murphy B. Exploring the neuromodulatory effects of vertebral subluxation. *Chiropr J Aust*. 2010;40:37-44.
- Keating J, Charton K, Grod J, Perle S, Sikorski D, Winterstein J. Subluxation: dogma or science. *Chiropr Osteopat*. 2005;13:17.
- Peters R. *An Early History of Chiropractic: The Palmers and Australia*. Asheville, NC: Integral Altitude; 2014.
- Palmer BJ. *The Science of Chiropractic: Eleven Physiological Lectures*, Vol. 2. Davenport, IA: The Palmer School of Chiropractic; 1907.
- Davis A. *Neurology, Embracing Neuro-Ophthalmology, the New Science for the Successful Treatment of All Functional Human Ills: Neuropathy, Chiropractic, Magnetism, Suggestive Therapeutics, Phrenology and Palmistry, as Related to Neuropathy*. Cincinnati, OH: F. L. Rowe; 1905.
- Faulkner T. *The Chiropractor's Protégé: The Untold Story of Oakley G. Smith's Journey with D.D. Palmer in Chiropractic's Founding Years*. Rock Island, IL: Association for the History of Chiropractic; 2017.
- Smith O, Langworthy S, Paxson M. *A Textbook of Modernized Chiropractic*. Cedar Rapids, IA: American School of Chiropractic; 1906.
- Gatterman M. Indications for spinal manipulation in the treatment of back pain. *ACA J Chiropr*. 1982;19(10):51-52.
- Gibbons R. Solon Massey Langworthy: keeper of the flame during the 'lost years' of chiropractic. *Chiropr Hist*. 1981;1(1):15-21.
- Johnson C. Modernized chiropractic: reconsidered: beyond foot-on-hose and bones-out-of-place. *J Man Phys Ther*. 2006;29(4):253-254.
- Gibbons R. Joy Loban and Andrew P. Davis: itinerant healers and "schoolmen," 1910-1923. *Chiropr Hist*. 1991;11(1):23-28.
- Zarback M. Chiropractic parallax: part 1. *Ill Prairie State Chiropractors Assoc J Chiropr*. 1988; January.
- Gaucher-Peslherbe P. *Chiropractic: early concepts in their historical setting*. Chicago, IL: National College of Chiropractic; 1993.
- Smith O. Clarinda Herald, Timothy Faulkner Archives; February 4, 1902. In: Faulkner T. *The Chiropractor's Protégé: The Untold Story of Oakley G. Smith's Journey with D.D. Palmer in Chiropractic's Founding Years*. Rock Island, IL: Association for the History of Chiropractic; 2017: 103.
- Banning JW. The importance of the atlas. *J Osteopat*. January 1901:13-15.
- Zarback M. Chiropractic parallax: part 5. *Ill Prairie State Chiropractors Assoc J Chiropr*. 1989;9(1):4-10.

27. Palmer BJ. Chiropractic: its value to suffering humanity. *The Davenport Times*; August 1902.
28. Burtch C. The relation of vertebral displacement to disease. *Backbone*. 1903;1(1):43-45.
29. *Announcement 1902*. Cedar Rapids, IA: American School of Chiropractic and Nature Cure; 1902. In: Faulkner T. *The Chiropractor's Protégé: The Untold Story of Oakley G. Smith's Journey with D.D. Palmer in Chiropractic's Founding Years*. Rock Island, IL: Association for the History of Chiropractic; 2017:131.
30. Palmer DD. Is chiropractic an experiment? *The Davenport Times*; June 14, 1902.
31. Waters T. *Fishing for Palmer in What Cheer: D.D. Palmer 1882-1886*. Raleigh, NC: Lulu, Inc.; 2015.
32. Palmer DD. Cured by magnetism. *The Burlington Daily Hawkeye: Sunday Morning*; October 9, 1887.
33. Palmer DD. *Chiropractic*. 1897;January(17).
34. Palmer DD. *Chiropractic*. 1897;March(18).
35. Palmer DD. *Chiropractic*. 1900(26).
36. Palmer DD. *The Science, Art, and Philosophy of Chiropractic*. Portland, OR: Portland Printing House; 1910.
37. Palmer DD. *Chiropractic*. 1902(29).
38. Palmer DD. *Innate Intelligence*. Davenport, IA: Palmer Infirmary and Chiropractic Institute; 1903.
39. Palmer DD. Communicating nerves. *Chiropr Adjust*. 1909;1(2):40.
40. Palmer D. *The Palmers*. Davenport IA: Bawden Brothers; 1967.
41. Palmer DD, Palmer BJ. Chiropractic book. *Chiropractor*. 1906;2(2):8.
42. Palmer DD, Palmer BJ. *The Science of Chiropractic*. Davenport, IA: The Palmer School of Chiropractic; 1906.
43. Palmer DD. Chiropractic defined. *Chiropractor*. 1904;1(1).
44. Palmer DD. Lesion versus sub-luxations. *Chiropractor*. 1906;2(3):13.
45. Palmer DD. Immortality. *Chiropractor*. 1906;2(3):14-16.
46. Palmer DD. Foreword. *Chiropr Adjust*. 1909;January;1(2).
47. Palmer DD. Foreword. *Chiropr Adjust*. 1909;1(2):29.
48. Moore S. *Chiropractic in America: The History of a Medical Alternative*. Baltimore, MD: Johns Hopkins University Press; 1993.
49. Wardwell W. *Chiropractic: History and Evolution of a New Profession*. St. Louis, MO: Mosby; 1992.
50. Drum D. The vertebral motor unit and intervertebral foramen. In: Goldstein M. ed. *The Research Status of Spinal Manipulative Therapy: A Workshop Held at the National Institutes of Health, February 2-4, 1975*. Bethesda, MD: U.S. Department of Health, Education, and Welfare; 1975:63-75.
51. Leach R. *The Chiropractic Theories: A Textbook of Scientific Research*. 4th ed. Philadelphia, PA: Lippincott; 2004.
52. Palmer DD. *Chiropractor*. 1905;1(5):1.
53. Palmer BJ. *Chiropractic Proofs*. Davenport, IA: Palmer Chiropractic School and Infirmary; 1903.
54. Palmer BJ. *Philosophy of Chiropractic*, Vol. 5. Davenport, IA: Palmer School of Chiropractic; 1909.
55. Palmer BJ. *The Philosophy and Principles of Chiropractic Adjustments: A Series of Thirty-Eight Lectures*, Vol. 3. Davenport, IA: Palmer School of Chiropractic; 1911.
56. *Catalogue of Copyright Entries*. Washington, DC: Library of Congress Copyright Office, Government Printing Office; 1907.
57. Palmer BJ. *Clinical Controlled Chiropractic Research*, Vol. 25. Davenport, IA: Palmer College; 1951.
58. Palmer DD. Luxations adjusted. *Chiropr Adjust*. 1909;1(2): 25-28.
59. Advertisement. Vol. 3: the science of chiropractic. *Chiropractor*. 1907;3(9-10):59.
60. Palmer BJ. *The Philosophy and Principles of Chiropractic Adjustments: A Series of Twenty-Four Lectures*, Vol. 3. Davenport, IA: Palmer School of Chiropractic; 1908.
61. Keating J. *B.J. of Davenport: The Early Years of Chiropractic*. Davenport, IA: Association for the History of Chiropractic; 1997.
62. Palmer BJ. *The Science of Chiropractic: Causes Localized*, Vol. 4. Davenport, IA: Palmer School of Chiropractic; 1908.
63. Palmer BJ. *The Philosophy, Science, and Art of Chiropractic Nerve Tracing: A Book of Four Sections*, Vol. 6. Davenport, IA: Palmer School of Chiropractic; 1911.
64. Davis AP. *Neuropathy: The New Science of Drugless Healing Amply Illustrated and Explained Embracing Ophthalmology, Osteopathy, Chiropractic Science, Suggestive Therapeutics, Magnetism, Instructions on Diet, Deep Breathing, Bathing etc.* Cincinnati, OH: F.L. Rowe; 1909.
65. Zarbuck M. Chiropractic parallax: part 2. *Ill Prairie State Chiropractors Assoc J Chiropr*. 1988;9(2):4-5, 14-16.
66. Smith O. *Naprapathic Genetics: Being a Study of the Origin and Development of Naprathy*. Chicago, IL: Author; 1932.
67. Zarbuck M. A profession for 'Bohemian chiropractic': Oakley Smith and the evolution of naprapathy. *Chiropr Hist*. 1986;6: 77-82.
68. Swanberg H. *The Intervertebral Foramina in Man: The Morphology of the Intervertebral Foramina in Man, Including a Description of Their Contents and Adjacent Parts, With Special Reference to the Nervous Structures*. Chicago, IL: Chicago Scientific Publishing; 1915.
69. Cramer G, Scott C, Tuck N. The holey spine: a summary of the history of scientific investigation of the intervertebral foramina. *Chiropr Hist*. 1998;18(2):13-24.
70. Palmer DD. *Letter to W.J. Joseph M. Foley Archives*. 1892; May 25.
71. Palmer DD. Cripples cured! The sick get well by magnetism. Ed, Borchert, Printer; 1889;June 20.
72. Waters T. *Chasing D.D.: D.D. Palmer in the News 1886-1913*. Raleigh, NC: Lulu, Inc.; 2013.
73. Palmer DD. *The Magnetic Cure*; 1896.
74. Palmer DD. *Chiropractic*. 1899;March(26).
75. Gaucher-Peslherbe P, Wiese G, Donahue J. Daniel David Palmer's medical library: the founder was "into the literature." *Chiropr Hist*. 1995;15(2):63-69.
76. Gaucher-Peslherbe P. DD Palmer as authentic medical radical. *J Neuromusculoskelet Syst*. 1995;3(4):175-181.
77. Palmer DD. *The Chiropractor*. Los Angeles, CA: Press of Beacon Light Printing Co; 1914.
78. Palmer DD. Letter to P.W. Johnson. May 4, 1911. In: Foley J. *D. D. Palmer's Second Book The Chiropractor - 1914 Revealed*. *Chiropr Hist*; 2017:72-86.
79. Gaucher-Peslherbe P. Defining the debate: An exploration of the factors that influenced chiropractic's founder. *Chiropr Hist*. 1988;8(1):15-18.
80. Gaucher-Peslherbe P. Chiropractic, an illegitimate child of science? II. De opprobria medicorum. *Eur J Chiropr*. 1986; 34:99-106.
81. Palmer BJ. *Fight to Climb*. Vol. 24. Davenport, IA: Palmer College; 1950.
82. Palmer DD. Letter to B.J. Palmer; June 6, 1906. Available at: <https://www.institutechiro.com/gens/first-generation-chiropractors/dd-palmer/books-and-writings/dd-palmer-letters-john-howard/>. Accessed November 28, 2018.
83. Nakamura J, Csikszentmihalyi M. The concept of flow. In: Csikszentmihalyi M, ed. *Flow and the Foundations of Positive Psychology*. New York, NY: Springer; 2014:239-263.

84. Albanese C. *A Republic of Mind and Spirit: A Cultural History of American Metaphysical Religion*. New Haven, CT: Yale University Press; 2007.
85. Stone A. *The New Gospel of Health: An Effort to Teach People the Principles of Vital Magnetism: or, How to Replenish the Springs of Life Without Drugs or Stimulants*. Troy, NY: Lung and Hygienic Institute; 1879.
86. Faulkner T, Foley J. The science, art, and philosophy of chiropractic by D.D. Palmer: identification and rarity of editions in print with a survey of original copies. *Chiropr Hist*. 2015;35(1):36-45.
87. Foley J. The chiropractor 1914: revealed. *Chiropr Hist*. 2017;37(1):75-76.
88. Bovine G. D.D. Palmer's adjustive technique for the posterior apical prominence: "Hit the High Places." *Chiropr Hist*. 2014;34(1):7-19.
89. Palmer DD. Chiropractic defined. *Chiropractor*. 1905;1(4).
90. Palmer BJ. *A Textbook on the Palmer Technique of Chiropractic*, Vol. 13. Davenport, IA: Palmer College; 1920.
91. Vedder H. *Chiropractic Physiology*, Vol. 8. Davenport, IA: Palmer College of Chiropractic; 1922.
92. Firth J. *Chiropractic Symptomatology*, Vol. 7. Davenport, IA: Palmer College of Chiropractic; 1925.
93. Palmer BJ. *History Repeats*, Vol. 27. Davenport, IA: Palmer College; 1951.
94. Ratledge T. *The Philosophy of Chiropractic*. Los Angeles, CA: Ratledge; 1949.
95. Drain J. *Man Tomorrow*. San Antonio, TX: Standard Print Co; 1949.
96. Palmer DD. Letter to the editor. *Religio-Philos J*. 1872;12(16):6.
97. Walton S. *The Complete Chiropractor: RJ Watkins, DC, PhC, FICC, DACBR*. Asheville, NC: The Institute Chiropractic; 2017.
98. Harper W. *Anything Can Cause Anything: A Correlation of Dr. Daniel David Palmer's Principles of Chiropractic*. Pasadena, TX: Texas Chiropractic College; 1997.
99. Toftness I. Philosophy of Chiropractic Correction. Wisconsin: I.N. Toftness, DC, PhC; 1977.
100. Epstein D. *Spinal system integrity. Network Spinal Analysis: Basic Level Intensive*. San Francisco, CA: Innate Intelligence, Inc; April 1996.
101. Weiant C. *Medicine and Chiropractic*. New York, NY: Chiropractic Institute; 1958.
102. Muller RO. *Autonomics in Chiropractic: The Control of Autonomic Imbalance*. Toronto, ON, Canada: The Chiro Publishing Co; 1954.
103. Homewood AE. *Neurodynamics of the Vertebral Subluxation*. 3rd ed. Homewood; 1981.
104. Keating J. Several pathways in the evolution of chiropractic manipulation. *J Man Phys Ther*. 2003;26(5):300-321.
105. Busse J, Wilson K, Campbell J. Attitudes towards vaccination among chiropractic and naturopathic students. *Vaccine*. 2008;26(49):6237-6243.
106. Morgan L. Innate intelligence: its origins and problems. *J Can Chiropr Assoc*. 1998;42(1):35-41.
107. Keating J. A brief history of the chiropractic profession. In: Haldeman S, ed. *Principles and Practice of Chiropractic*. New York, NY: McGraw Hill; 2005.
108. McAulay B. Rigor in the philosophy of chiropractic: beyond the dismissivism/authoritarian polemic. *J Chiropr Humanit*. 2005;12:16-32.
109. Mirtz T. Universal intelligence. *J Chiropr Humanit*. 1999;9:55-71.
110. Keating J, William D, Harper Jr MS. DC: Anything Can Cause Anything. *J Can Chiropr Assoc*. 2008;52(1):38.
111. Gatterman M. *Foundations of Chiropractic Subluxation*. 2nd ed. St. Louis, MO: Mosby; 2005.
112. Keating J, Callender A, Cleveland CA. *History of Chiropractic Education in North America*. Rock Island, IL: Association for the History of Chiropractic; 1998.
113. Zarbuck M, Hayes M. Following D.D. Palmer to the west coast: the Pasadena connection, 1902. *Chiropr Hist*. 1990;10(2):17-19.
114. Peters R, Chance M. Disasters, discoveries, developments, and distinction: the year that was 1907. *Chiropr J Aust*. 2007;37:145-156.
115. Gibbons R, Wiese G. Fred Rubel: the first black chiropractor? *Chiropr Hist*. 1991;11(1):8-9.
116. Keating JC. "Heat by nerves and not by blood": the first major reduction in chiropractic theory, 1903. *Chiropr Hist*. 1995;15(2):70-77.
117. Troyanovich S, Gibbons R. Finding Langworthy: the last years of a chiropractic pioneer. *Chiropr Hist*. 2003;23(1):7-16.
118. Gibbons R. Assessing the oracle at the Fountainhead: B.J. Palmer and his times, 1902-1961. *Chiropr Hist*. 1987;7(1):8-14.
119. Zarbuck M. Chiropractic parallax: part 3. *Ill Prairie State Chiropractors Assoc J Chiropr*. 1988;9(3):4-5,17-19.
120. Keating J. *Toward a Philosophy of the Science of Chiropractic: A Primer for Clinicians*. Stockton, CA: Stockton Foundation for Chiropractic Research; 1992.
121. Palmer DD. Chiropractic rays of light. *The Chiropractor*. 1905;1(7):17-23.
122. Leach R. *The Chiropractic Theories: A Textbook of Scientific Research*. 3rd ed. Baltimore, MA: Williams and Wilkins; 1994.
123. Rehm W. Necrology. In: Dzaman F, ed. *Who's Who in Chiropractic International*. 2nd ed. Littleton, CO: Who's Who in Chiropractic International Publishing Co; 1980.
124. Rosenthal M. The structural approach to chiropractic: from Willard Carver to present practice. *Chiropr Hist*. 1981;1(1):25-28.
125. Leach R. *The Chiropractic Theories: A Synopsis of Scientific Research*. Mississippi State, MS: Mid-South Scientific Publishers; 1980.
126. Leach R. *The Chiropractic Theories: A Textbook of Scientific Research*. 4th ed. Baltimore, MD: Williams and Wilkins; 1986.
127. Verner J. *The Science and Logic of Chiropractic*. 8th ed. Brooklyn, NY: Dr. P.J. Cerasoli; 1956.
128. Terrett A. The genius of D.D. Palmer: An exploration of the origin of chiropractic in his time. *Chiropr Hist*. 1991;11(1):31-38.
129. Coulter I. *Chiropractic: A Philosophy for Alternative Health Care*. Woburn, MA: Butterworth-Heinemann; 1999.
130. Meeker W, Haldeman S. Chiropractic: a profession at the crossroads of mainstream and alternative medicine. *Ann Intern Med*. 2002;136:216-217.
131. Schafer R. *Basic Chiropractic Procedure Manual*. Des Moines, IA: ACA; 1973.
132. Cooperstein R, Gieberzon B. *Technique Systems in Chiropractic*. Philadelphia, PA: Churchill Livingstone; 2004.
133. Senzon S. Chiropractic and systems science. *Chiropr Dialogues*. 2015;25:9-20.
134. Gregory AS. *Spinal Adjustment: An Auxillary Method of Treatment*. Oklahoma City, OK: Author; 1910.
135. Loban J. *Technic and Practice of Chiropractic*. 2nd ed. Denver, CO: Loban Publishing Co; 1915.
136. Forster A. *Principles and Practice of Spinal Adjustment*. Chicago, IL: The National School of Chiropractic; 1915.
137. Carver W. *Carver's Chiropractic Analysis*. 2nd ed. Davenport, IA: Universal Chiropractic College; 1915.

138. Coleman R, Wolf K, Dever L, Coleman J, Wenham T. Does the chiropractic of modernized chiropractic still live? *Chiropr Hist.* 2015;35(2):20-35.
139. Clusserath M. Vertebral subluxation and a professional objective for chiropractic. *J Chiropr Humanit.* 1999;9:9-20.
140. Palmer BJ. *Our Masterpiece*, Vol. 39. Davenport, IA: Palmer School of Chiropractic; 1966.
141. Boone W, Dobson G. A proposed vertebral subluxation model reflecting traditional concepts and recent advances in health and science. *J Vert Subl Res.* 1996;1:19-36.
142. Barge F. *Life Without Fear: Chiropractic's Major Philosophical Tenets*, Vol. V. Eldridge, IA: Bawden Brothers, Inc.; 1987.
143. Haldeman S, Drum D. The compression subluxation. *J Clin Chiropr.* 1971;7:10-21.
144. Drain J. *Chiropractic Thoughts*. San Antonio, TX: Alumni Association of the Texas Chiropractic College; 1927.
145. Smallie P. *Scientific Chiropractic*. Stockton, CA: World-Wide Books; 1984.
146. Higley H. Chiropractic philosophy: an interesting interpretation of basic tenets. *Chiropr J.* 1938;7(2):13-14, 54-55.



The Chiropractic Vertebral Subluxation

Part 4: New Perspectives and Theorists

From 1916 to 1927

Simon A. Senzon, MA, DC

ABSTRACT

Objective: The purpose of this paper is to review and discuss the history of chiropractic vertebral subluxation (CVS) between the years 1916 and 1927.

Discussion: Theories during this period were shaped by many chiropractic school leaders and instructors. Unique contributions to theories during this period come primarily from 4 authors, John Craven, Jim Drain, Shelby Riley, and Ralph Stephenson. This period included the first thermographic instrumentation in chiropractic, which led to one of Craven's modifications of CVS theory. He also added to the literature about spinal cord pressure and developed the restoration cycle. Drain and Stephenson also expanded on the cord pressure models of CVS. Drain wrote, in plain language, of many central B. J. Palmer theories and developed protocols for acute and chronic CVS. Stephenson made several contributions to models, including his expansion on B. J. Palmer's theory of momentum of dis-ease. Stephenson's main contribution to theory was likely his vertemere cycle, which was a precursor to proprioceptive models. Riley's combination of Gregory's theories with zone therapy had a significant impact on several reflex theories.

Conclusion: Chiropractic vertebral subluxation theory during this period grew in complexity and demonstrated several new perspectives on CVS, which may be still relevant today. (J Chiropr Humanit 2018;25C:52-66)

Key indexing terms: *Chiropractic; History*

INTRODUCTION

The concepts surrounding chiropractic vertebral subluxation (CVS) increased in complexity between 1916 and 1927. Influential books were published by established school leaders such as B. J. Palmer, Arthur Forster, and Willard Carver. New thought leaders, such as John Craven, Joe Riley, Jim Drain, and Ralph Stephenson, emerged and contributed to the literature about CVS theory (Fig 1). For this paper, the years 1916-1927 were selected because of the publications and events that led to the development of new theories and new approaches to research and the analysis of the CVS. For example, 1916 marked the beginning of B. J. Palmer's collaboration with his new full-time faculty, which started with the publication of the second edition of volume 5 in collaboration with John Craven.¹⁻³ The year 1927 was marked by the publication of Stephenson's *Chiropractic Textbook* and Drain's *Chiropractic Thoughts*.^{4,5}

Theory developed based on several factors including the proliferation of texts,^{1-4,6-9} competition among schools,¹⁰ expanded student clinics, increased teaching loads, attempts to integrate chiropractic with other therapeutic models, the development of instrumentation,^{11,12} and a unique confluence of events such as the influx of students into chiropractic colleges after World War I and the flu pandemic of 1918.^{5,8,10}

Theory during this period included new distinctions between acute and chronic CVS,^{4,5,12} further development of cord pressure models,^{4,12} reflex models,^{13,14} early proprioceptive models,⁴ and expanded models of etiology.^{4-6,9,15} Some of the theories from this era made new distinctions between philosophy and CVS theory.⁴⁻⁶

The purpose of this article is to review the writings of the CVS theorists and the impact of instrumentation on these theories. This is followed by an exploration of the models from 4 authors: Craven, Riley, Drain, and Stephenson. Each made unique contributions to theory, which are summed up with a section on the new CVS perspectives that emerged during this time. This is followed by a discussion that explores the importance of a systems approach, the use of innate intelligence, and terminology.

DISCUSSION

Chiropractic Vertebral Subluxation Theory Between 1916 and 1927

Between 1916 and 1927 chiropractic school leaders, such as B. J. Palmer, Arthur Forster, and Willard Carver,

School of Health and Human Sciences, Southern Cross University, Lismore, New South Wales, Australia.

Corresponding author: Simon A. Senzon, MA, DC, 218 E. Chestnut Street, Asheville, NC 28801. Tel.: +1 828 251 0815. (e-mail: Simon@institutechiro.com).

Paper submitted May 18, 2016; accepted May 15, 2018. 1556-3499

© 2018 by National University of Health Sciences.
<https://doi.org/10.1016/j.echu.2018.05.001>

expanded on earlier theories. New authors (Craven, Riley, Drain, and Stephenson) had an increasing influence on discourse regarding CVS theory. Many of the new theories were inspired by new measures to try to detect CVS such as using thermographic instrumentation.

B. J. Palmer issued new editions of his earlier theoretical books that were published in 1916 and 1920.^{1,2} His publication of the second edition of volume 5 with Craven as his collaborator might be viewed as the start of this period. Also in 1920 B. J. Palmer published his full-spine adjusting manual as volume 13.³ The book was compiled by his faculty, Vedder, Firth, and Burich, and influenced future manuals and techniques.¹⁶⁻¹⁸ In 1924 Palmer introduced thermographic instrumentation into the profession.¹⁹

Other authors worked on theories related to CVS. Forster, who was head of the chiropractic program at National School of Chiropractic, published 2 more editions of his book by 1923.²⁰ In 1921, he published *The White Mark*,⁸ which was a collection of his editorials from the *National Journal of Chiropractic*. Forster viewed subluxations as secondary to disease processes. He wrote, "It may be said without question that in 95 per cent of all diseases a subluxated vertebra has something to do with their causation."⁸ Carver published several texts during this period to support his lectures at his various schools.^{10,21} He expanded on his models of distortion, symptomology, adjusting methods, and his full-spine structural approach to CVS.⁷ The works of Craven, Riley, Drain, and Stephenson described how CVS was developed and included instrumentation along with other models of neuropsychology and even acupuncture theory.

Instrumentation and Early Theory. I propose that the development of CVS theory after 1923 should be discussed in the context of instrumentation. After this date, CVS models and the technologies used in research and analysis became linked and developed together.

Thermography in chiropractic was a technological innovation that was used to locate areas of heat over the spine. This was a procedure that had been used since the earliest years of the profession and was central to the theory of CVS detection. D. D. Palmer described palpating for heat in relation to CVS as early as 1902.²² He wrote, "Observe the difference in temperature of your patients along the spine, of those having fever, by placing your hand at

different points; where you find the greatest heat, there you will find the sub-luxation causing the inflammation which produced the fever."²² In 1908, B. J. Palmer wrote that one should adjust the "spinal hot box" for eruptive fevers.²³ Thus before the thermograph, heat was detected with the back of the bare hand.²⁴

Thermography instrumentation was first tested in chiropractic in 1923 with B. J. Palmer's Neurocalometer, a device developed by an engineer named Dossa Evins.¹¹ Thermographic instrumentation was used to measure physiological changes that were thought to be associated with CVS.¹⁹ By 1924, when B. J. Palmer officially introduced the Neurocalometer as a way to detect interference to the neurologic component of the CVS, other devices were already on the market by schools from Texas Chiropractic College (TCC) to Los Angeles Chiropractic College.²⁵ These included Chiro Vox,⁵ the E.R.V. potentiometer, and the J. W. Healey X-Ray Company's Neurophonometer, Neurothermometer, and Neuropyrometer.²⁵

In 1927 Weiant and Gravelle suggested that acute CVS caused inflammation.²⁶ Weiant was a 1924 Palmer School of Chiropractic (PSC) graduate and Gravelle was a physicist. Under monochromatic light, they observed the paravertebral tender spots had a purple color that matched the wavelength of hemoglobin. Microscopic analysis indicated dilated capillaries. They invented the Analyte, "a lamp for visual nerve tracing."²⁷ By 1952, Weiant developed the Visual Nerve Tracing Instrument with Adelman to photograph the capillaries that they theorized were associated with CVS.²⁸

John Craven's Writings. John Craven joined the PSC faculty on graduation in 1912 (Fig 2). He started publishing articles in *The Chiropractor* in 1914.²⁹ Some of his articles summarized B. J. Palmer's theories on cycles and eventually became core chapters of the second edition of *Philosophy of Chiropractic*, volume 5, published in 1916.¹ Craven also collaborated with B. J. Palmer on the third edition of volume 2 in 1920 and authored his own books, *Chiropractic Orthopedy* in 1921, and *Chiropractic Hygiene* in 1924.^{2,6,30} *Chiropractic Orthopedy* expanded on B. J. Palmer's theories of spinal cord pressures.⁶ In 1925 Craven published an article on CVS theory based on research with the first thermography instrumentation.¹²

Craven's main writings in the 1916 edition of volume 5 were part of his chapter on the restoration cycle, which

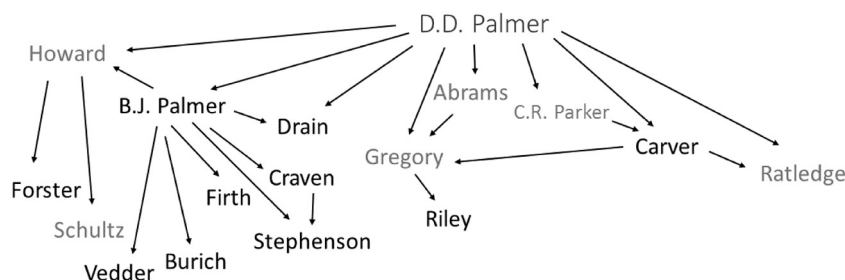


Fig 1. Subluxation theorists between 1916 and 1927.



Fig 2. John Craven. (Courtesy Special Services, Palmer College of Chiropractic.)

included the concept that after the CVS is adjusted, normal transmission is restored.¹ Restoration was a concept developed by both D. D. and B. J. Palmer.^{31,32} Craven was the first to refer to this as the *restoration cycle*,¹ which he connected to B. J.'s theory of cycles.³²

The natural restorative process was central to his theory. Most of Craven's writings on CVS came after 1920. He wrote that after the correction of CVS, "the current of impulses may become normal, and when we have done that, then we should leave our patient to the life within the body for all the processes of reparation and restoration, and when we have done that we have done our patient a real service and the patient will recover."³³ Rather than philosophizing about "life," Craven was interested in the processes and the practicality of patient care. The key was "to restore incoordination to coordination."³³

Craven's chapter on spinal cord pressures was published in 1921.⁶ He updated B. J. Palmer's writing on the topic from 1911.³⁴ B. J. Palmer based his original model on Primrose's cord pressure hypothesis.³⁵ Craven proposed that cord pressures existed within the spinal canal and may refer pressure to a few fibers depending on the degree of CVS.⁶ The most common places of pressure, he thought, were areas where the cord was enlarged, especially the middle cervical area (Fig 3).⁶ Cord pressure was proposed

to be caused by trauma, pathologic conditions within the cord, or pulling on the cord from sacrum or coccyx. He proposed that pulling on the cord from the coccyx could cause pressure anywhere along the spine and that tenderness could be found below the point of spinal cord pressure. Craven suggested that coccyx and sacrum cord pulling was rare.⁶

In December 1925 Craven introduced the first theoretical modifications to CVS theory, which were based on instrumentation.¹² He reported that chronic and acute CVS produced different thermographic readings and concluded that chronic CVS may have pressure but no interference. Craven hypothesized that the full carrying capacity of the nerve is not normally active. He differentiated carrying capacity of the nerve from interference with transmission.¹² According to Craven, this new distinction between interference and lowered capacity explained why some acute conditions appeared from an unchanged chronic CVS. He felt that it also accounted for the ability to increase activity and function when required by the environment. He wrote, "In many cases it is an old, chronic CVS that may have existed for years. It is not necessary to assume that there is interference with transmission at all times on that nerve, and as a matter of fact the Neurocalometer has shown there is not."¹²

In those cases when the body required more "current" over the nerve for function rather than for basic metabolism, thermographic readings changed. Craven hypothesized that when increased need demanded greater current, the pressure from this type of CVS interfered with the greater current. This, he felt, occurred even though it was not interfering with basic metabolism. He also proposed that chronic CVS may produce interference with the transmission to the tissues, which caused tissue weakness and depletion. In those types of chronic CVS, the tissues no longer have the capacity to effectively adapt.¹² This was the introduction of a new chronic CVS theory: Chronic CVS may not always have interference to transmission because transmission could be intermittent and related to functional need.

Joe Shelby Riley's Theory (1921). Joe Shelby Riley graduated from the Palmer-Gregory School in 1911 under his mentor Alva Gregory (Fig 4).¹⁰ Riley and Gregory spearheaded a multistate agenda to combine medical practices into chiropractic.¹⁰ Riley claimed degrees from many fields including medicine, osteopathy, and naturopathy. The author page in his 1921 book reads, "Joe Shelby Riley, M.D., M.S., Ph.D., LL.D., N.D., F.A.S., D.M.T., D.P., D.O., B.D., D.C., Ph.C."¹³ He opened a school in New England in 1912. Wardwell suggested that chiropractors drove him out of Massachusetts and so he moved to the District of Columbia and opened the Washington School of Chiropractic in 1914. That school closed in 1926.³⁶ Riley apparently was not highly regarded by some in the profession.^{10,36}

Riley published books in 1917, 1919, and 1921, including his *Science and Practice of Chiropractic with Allied Sciences*.^{9,13,15} Riley developed many of his ideas from

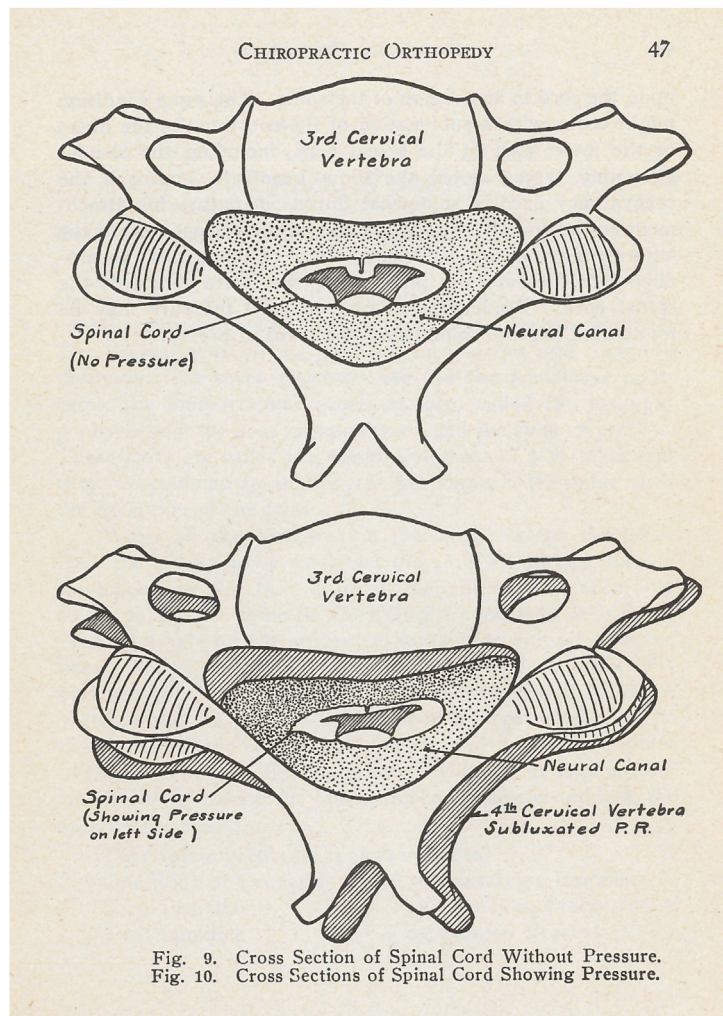


Fig 3. Figures from Craven's *A Textbook on Chiropractic Orthopedy*⁶ (drawn by R. W. Stephenson). (Courtesy Special Services, Palmer College of Chiropractic.)

Gregory, although he also gave credit to D. D. Palmer and B. J. Palmer. Riley taught many alternative healing methods under the title of chiropractic including osteopathic manipulation, spondylotherapy, instrument adjusting, rectal dilation, lamps, vibrators, and naturopathy. Keating, Callender, and Cleveland referred to Riley as "the maximum mixer of his era."¹⁰ By 1921 he had developed his Plus Ultra triad (Fig 5), which included medicine and surgery (chemistry, bacteriology, obstetrics, and gynecology), physiotherapy (electrotherapy, thermotherapy, pneumotherapy, and zone therapy), and spinal therapy (chiropractic, concussion, sinusoidalization, and mechanotherapy).¹³

In 1921 Riley proposed that adjustment of CVS removed the pressure on the nerves. The adjustment replaced the vertebra causing the impingement, which then released the interference.^{9,13} His theory was a mix of both D. D. and B. J. Palmer's CVS models with Gregory's approach to stimulate or inhibit the nervous system, which was based on Abrams' spondylotherapy. Riley suggested

best results started with a chiropractic adjustment followed by concussive therapy. He proposed that slow concussive strokes inhibited the nervous system and rapid strokes excited the nervous system.¹³ This theory is credited to Davis, Gregory, and Abrams.³⁷⁻³⁹

Riley's main innovation during this period was his inclusion of zone therapy, which was first introduced by 2 medical doctors in January 1917 as an adaptation of acupuncture meridian theory to pain management.^{40,41} Riley published his first edition of *Zone Therapy Simplified* later that year.¹⁵ Zone therapy integrated elements of acupuncture theory with regular medicine. It was a precursor to reflexology, which was started by Riley's student Eunice Ingham.⁴² By 1921 Riley had integrated zone therapy with his wider system, which included chiropractic.¹³

Drain's Theory (1927). James Drain was a 1911 graduate of the PSC (Fig 6). He studied under B. J. Palmer and also took 11 lessons from D. D. Palmer in 1913.⁴³ Drain attended at least 12 Palmer homecoming events before buying TCC in

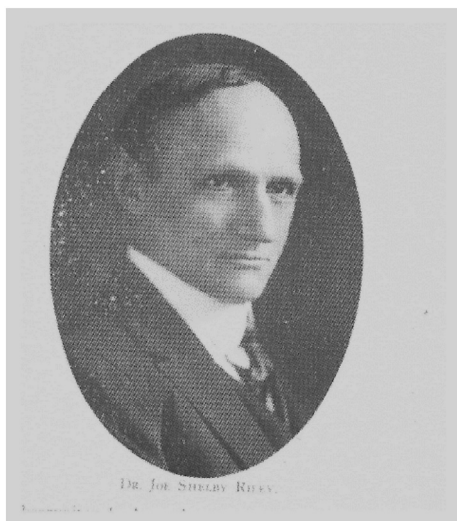


Fig 4. Joe Shelby Riley. (Courtesy Special Services, Palmer College of Chiropractic.)

1921.⁵ Drain published his *Chiropractic Thoughts* in 1927.⁵ Drain wrote that CVS puts pressure on nerve coverings and the coverings of the spinal cord. His writings on retracing,

pediatric care, multiple cord pressures, and momentum of disease processes are informed by years of clinical experience and teaching and by his study of the first B. J. Palmer texts.⁵ Drain recommended adjusting CVS in only 1 or 2 areas. He felt this concentrated the force that could be used by innate intelligence. He hypothesized that adjusting more than 3 vertebrae scattered the force from the adjustment.^{5,44} One of Drain's practices was, throughout the night, to adjust acute patients who were considered to have a high risk of imminent death. He rechecked the patients every 6 hours. He felt that if the innate contraction of forces, which was a concept of B. J. Palmer's from 1908,⁴⁵ did not last for 6 hours, then clinical judgment should rule on how frequent adjustments should be delivered.⁵

Drain noted that cord pressure concepts were first developed between 1908 and 1911,⁵ which concurs with B. J. Palmer's first incorporation of cord pressures into CVS theory from the second edition of volume 3.³⁴ Drain suggested that the most common location for spinal cord pressure was at the level of the atlas and axis, although it may be found at any level of the spinal canal. He noted that signs and symptoms of cord pressure could include shooting pains in the body, paralysis of half of the body, tender nerves below

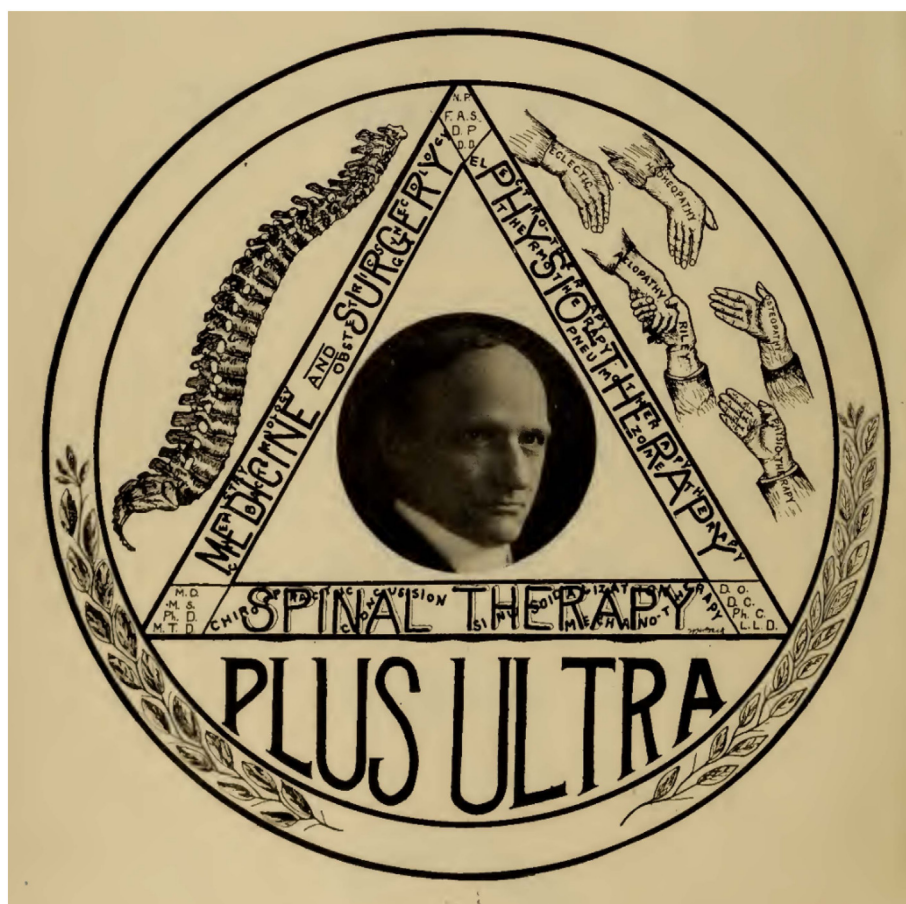


Fig 5. Plus Ultra Triad from Riley's *Conquering Units: Or the Mastery of Disease*.¹³

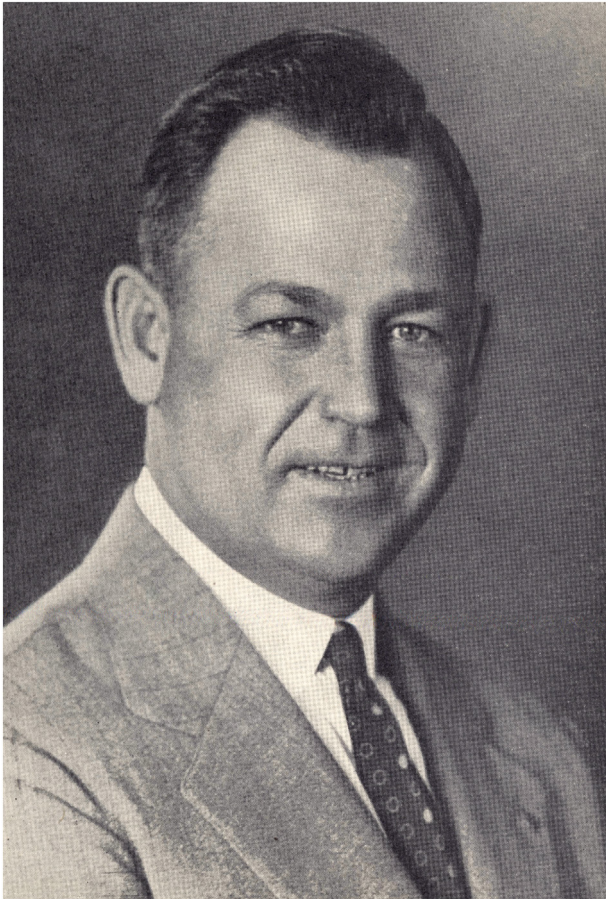


Fig 6. James R. Drain. (With permission from the Drain family.)

the point of pressure, and even hysteria and nervous breakdown. Any pathophysiologic condition, he postulated, could be related to cord pressure, mainly caused by anterior, posterior, and lateral CVS. Each type of cord pressure CVS could lead to different clinical findings. He wrote that even a slight cervical CVS could put pressure on the cord.⁵ Clinically, adjusting the highest point of cord pressure was the rule. An assessment of primary and compensatory curves was crucial to determining whether the cord pressure was causative.⁵

Drain expanded on B. J. Palmer's theory of major and minor CVS, distinguishing between the two.⁵ A major CVS was characterized by a hot spot, a cold spot, or a tender nerve and could include any combination of these. He also relied on x-ray analysis whenever possible to determine laterality of the vertebrae in relation to the articulations above and below. Other methodologies included Kiro Vox (a thermography instrument developed at TCC), symptomology, history, palpation, and nerve tracing.⁵

R. W. Stephenson's Theory (1927). Stephenson graduated from PSC in 1921 and joined the faculty (Fig 7). He taught in the philosophy, orthopedy, and technique departments.²⁴ Stephenson first started writing about the fundamental

principles of chiropractic in 1924, including information on neurocalometer research.⁴⁶ By 1927 he had written his own text, *Chiropractic Textbook*.⁴ In the preface to his 1927 text, Stephenson thanked his teachers B. J. Palmer and John Craven.⁴ He developed the classic 33 principles to sum up B. J. Palmer's chiropractic philosophy and theory.⁴ The CVS was described as principle 31 in relation to the body's inability to adapt to ill-timed or unbalanced forces from the environment. A second edition of his book was published in 1940. The book became a core text at the PSC for decades and influenced tens of thousands of chiropractors. Stephenson also created the drawings for Craven's orthopedy text.⁶

Stephenson defined CVS according to B. J. Palmer's classic 4 criteria: misalignment, occlusion, pressure, and interference. Stephenson wrote, "A subluxation is the condition of a vertebra that has lost its proper juxtaposition with the one above or the one below, or both; to an extent less than a luxation; which impinges nerves and interferes with the transmission of mental impulses."⁴ That definition guided theory for many in the profession.¹⁰

Stephenson viewed the CVS in the context of the organism's intelligent attempt to adapt to the environment.⁴



Fig 7. R. W. Stephenson. (Courtesy Special Services, Palmer College of Chiropractic.)

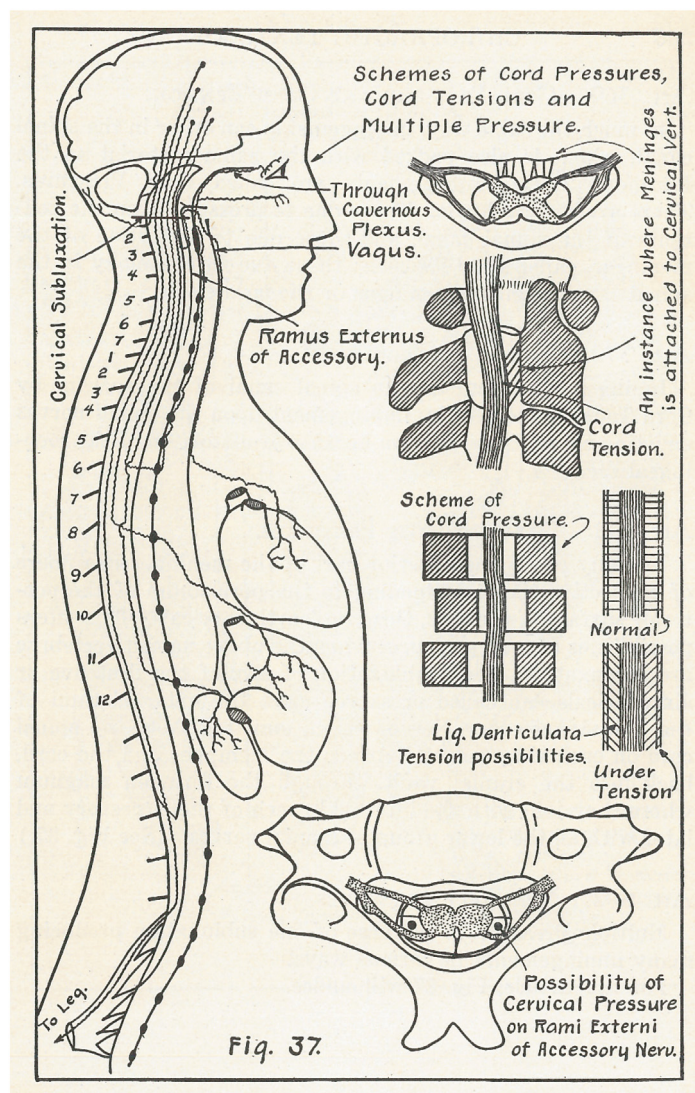


Fig 8. From R. W. Stephenson's *Chiropractic Textbook*.⁴ (Courtesy Special Services, Palmer College of Chiropractic.)

This was an early systems approach to the body's organizing processes based on complex cycles, a detailed exploration of momentum in health and disease, and an energetic perspective on the nervous system.^{47,48}

Stephenson distinguished several kinds of impingements and cord pressures.⁴ He built on Craven's and B. J. Palmer's cord pressure models.^{6,34} He hypothesized that cord pressures arose from pathologic conditions, like a tumor in the cord, canal, or meninges, and that, "those due to pressure upon the contents of the spinal canal, and those due to distortion of the meninges, [were] called Cord Tension."⁴ He also referred to sacral impingements within the spinal canal as cord tensions. He proposed that cervical CVS, especially of the second, third, and fourth cervical vertebrae, caused cord pressures because of the attachments of connective tissue to the meninges; he felt that the first 6

cervical vertebra could cause pressure on the external rami of the spinal accessory nerve.⁴ Stephenson's illustrations of multiple cord pressures are similar to depictions of adverse mechanical cord tension by neurosurgeon Alf Breig, published 50 years later (Figs 8 and 9).^{4,49} More recent research demonstrates that suboccipital muscles have direct attachments to the meninges.⁵⁰ Stephenson hypothesized that the CVS impinged not only nerves going to other tissues and organs in the body but also to the tissues that hold vertebrae in place. The vertemere region affected by the CVS included the vertebra, discs, muscles, and ligaments. The interference to the transmission of mental impulses in this region kept the body's innate intelligence from self-correcting. He called this the *vertemere cycle* and suggested it is the reason why chronic CVSs were perpetuated. Stephenson considered this the only practical

cycle for chiropractic application in relation to the other cycles developed by B. J. Palmer and Craven.^{1,4}

Different CVS Perspectives

At least 5 perspectives on CVS theory emerged during this time period; more sophisticated cord pressure models, expanded etiologic and adaptive premises, inhibition and excitation methods associated with reflex zones, the use of technology to study and analyze physiological changes associated with CVS, and new theories about chronic and acute CVS care (Fig 10). This last perspective integrated some of the others but truly emerged in the crucible of the flu pandemic of 1918. The emerging instrumentation perspective was discussed earlier. The other perspectives will be explored next.

Acute Perspective. The impact that chiropractic had on the flu pandemic in the United States is difficult to gauge and important to frame for the modern reader. Forster and his team tried to capture it. He wrote⁸:

During the influenza epidemic last year thousands of people suffering from this disease, as well as pneumonia, were cared for by Chiropractors. Many of the patients who received adjustments had been given up to die by their attending physician. They were not, therefore, what could be called favorable cases upon which to test out the merits or demerits of Chiropractic...But the fact remains that the majority owed their recovery to Chiropractic...Reports covering about thirty thousand cases were collected and statistics

compiled thereupon showed that the mortality rate under spinal adjustment was almost insignificant, being less than one-eighth per cent.

He continued⁸:

The published report of these remarkable results gave Chiropractic an impetus that could not have been equaled by fifty years of ordinary progress. It has shed an undying lustre on the profession. It has raised Chiropractic in the popular esteem to a degree impossible to estimate...

Forster cited one-eighth of a percent for fatality rates. The global mortality rate for this pandemic was 2.5%.⁵¹ If Forster's statistics were correct, then chiropractors would have had greater success than orthodox medical approaches. A more detailed study is warranted to explore this further.

Forster reasoned that if 1 million case studies per year could be documented, this would provide statistically irrefutable evidence for the efficacy of chiropractic adjustments of CVS. To accomplish this, he suggested that the 10 000 chiropractors in the field produce case studies on 100 patients per year.⁸

Another aspect of the flu pandemic was captured in the writings of Drain while he was practicing in the countryside of Texas with a horse and buggy. Drain built his practice on house calls.⁵ He wrote⁵:

In the acute cases, I do not know of anything more acute than influenza or pneumonia. I kept a record of my cases up until I got sick myself and I submitted that

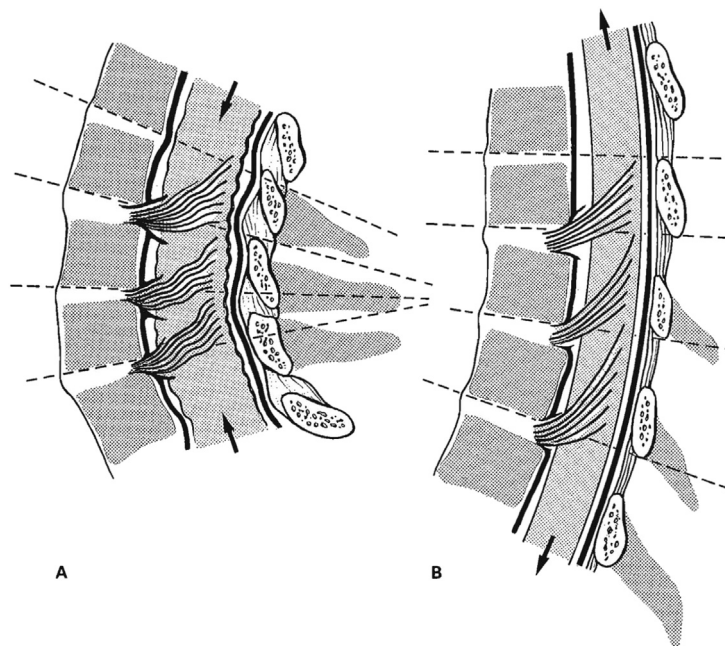


Fig 9. The biomechanical effects of postural changes on the soft tissues in the cervical canal. (A) Extension. Slacked nerve roots and protruding ligamenta flava. (B) On flexion, elongation of the cord and nerve roots is permitted by the slackening of the cord tissue and elasticity of the fibers. (From Breig's adverse mechanical cord tension.⁴⁹ With permission from Michael Shacklock and Neurodynamic Solutions.)

Subluxation Perspectives	Some New Hypotheses
Expanded Cord Pressure Perspective	<ul style="list-style-type: none"> • Cord pressures may develop from the cervical and sacral spine with referred pressure depending on degree of subluxation. Cord pressures may be located primarily at the upper cervical spine with various signs and symptoms as well as different clinical findings. This could arise from internal pathologies.
Excitation/Inhibition Perspective	<ul style="list-style-type: none"> • Slow concussive forces may inhibit the nervous system and quick forces may excite. This approach may engage reflex systems associated with acupuncture meridians.
Adaptation Perspective	<ul style="list-style-type: none"> • Ability to adapt is central to the chiropractic paradigm. It may be diminished with chronic subluxations, the body's inability to adapt to ill-timed or unbalanced forces relates to subluxation etiology, may be related to a reserve capacity of nerves.
Chronic Perspective	<ul style="list-style-type: none"> • Distinct thermographic heat patterns, may have pressure but no interference, tissue adaptability is reduced, may be related to proprioceptive cycles or vertemere cycles.
Acute Perspective	<ul style="list-style-type: none"> • Causes inflammation, distinct thermographic heat readings, required more frequent adjustments based on innate contraction of forces.

Fig 10. *New hypotheses related to each of these perspectives.*

record to the authorities down there, of attending 473 cases diagnosed by the health physician as Spanish influenza, or three-day fever. In the 473 cases not a single case developed pneumonia, and only three died.

This personal account gives the modern reader an appreciation for the intensity through which the acute CVS perspective was developed. Although it is unknown if any cause and effect relationships existed because no definitive information is available, chiropractors would spend the next several decades theorizing how their observations of positive health outcomes could be related to global changes in the central nervous system.⁵²⁻⁵⁷

Chronic Perspective. According to Drain, distinctions between acute and chronic CVS were developed in response to severe cases.⁵ Stephenson and Craven also came up with chronic and acute models. Stephenson's vertemere cycle was a precursor to proprioceptive models of CVS.⁴ Both Drain and Stephenson wrote extensively on momentum in health, disease, and "dis-ease." Craven hypothesized that chronic CVS may have periodic interference to nerve transmission.¹² Craven, Drain, and Stephenson, along with Firth, agreed with B. J. Palmer's dictum that CVS was the physical representative of the cause of "dis-ease."^{4,5,16,58} Aspects of their work were incorporated by B. J. Palmer into the development of his later theories.^{59,60} For example, Craven's line of reasoning about interference, based on his observations of thermography patterns in the early 1920s,¹² was later used by B. J. Palmer, who studied similar phenomenon for the next 10 years.^{19,59,61}

Adaptation Perspective. Craven suggested that adaptation to the constant changes from the environment dictated the need for an increase of nerve current.¹² This theory refuted Forster's claim that the Palmer theory included a constant flow of nerve energy as an all or nothing principle of CVS.²⁰ Craven argued, instead, that adaptation required that nerves have a reserve capacity.¹²

For years, adaptation had been central to the philosophy of chiropractic and its relationship to the CVS.^{4,31,54,62} Stephenson and Drain both included adaptation models as central to their theories.^{4,5} Future research could test their hypotheses with current adaptation models such as modern theories like allostasis and salutogenesis.^{63,64}

Excitation/Inhibition Perspective. Future theorists built not only on the works of the Palmers, Firth, Loban, Carver, Forster, Craven, Drain, and Stephenson but also those of Gregory and Riley. Riley incorporated Gregory's theories of excitation and inhibition along with the zone therapy meridian system. This affected reflex techniques, which were developed in the 1930s by theorists including Hurley, Logan, and DeJarnette.^{13,39,65-67} B. J. Palmer and many of his students disagreed that inhibition and stimulation should be included in chiropractic because the approach was derived from therapeutic models.⁵⁹ In their paradigm, based on D. D. Palmer's theories, the chiropractic adjustment was enough to normalize the nervous system.

Years later, Carl S. Cleveland, a 1917 PSC graduate and founder of Cleveland Chiropractic School in Kansas City, refuted the concept of adjustment to stimulate or inhibit the nervous system. In the preface to his book, Cleveland wrote, "The purpose of an adjustment is not to depress or not to stimulate! But, to remove interferences with transmission, or pressures, from the affected nerve thus restoring normal nerve supply."⁶⁸ Cleveland then described how innate intelligence potentially decreased or increased the function of the organ systems. This principle is congruent with the teachings of the Palmers.

Critical Review and Discussion of Previous Works

There is little peer-reviewed literature exploring the CVS theories of this period, especially the works of Craven, Riley, Drain, and Stephenson. Even though Stephenson's text is well known, it is not well cited in the literature.

References to Stephenson usually indicate his 33 principles, not his CVS theories.^{4,36,69-72} This era had an impact on future theory and so it is important to discuss some of the issues associated with it.

Examining this period of CVS theory leads to several other interesting areas of inquiry about chiropractic theory in general. Some of the distinctions made during this era are still relevant today, such as the systems approach, the differentiation of innate intelligence in terms of biological self-organization, the implications for differentiation to CVS theory, and the importance of including these issues in any critiques of philosophy or CVS theory in the modern literature.

Systems Thinking. D. D. Palmer's chiropractic paradigm arose from an early systems approach and a holistic worldview.⁷³ Several authors have equated D. D. Palmer's thinking to a systems approach.⁷³⁻⁷⁵ The chiropractic paradigm views the biological organization of the organism within the greater context of environmental perturbations.^{76,77}

Three examples illustrate how this short period continued that systems perspective. Instrumentation evolved into a global and systemic viewpoint about how the CVS affected long-term patterns.⁷⁸ The adaptation perspective situated the organism within the context of the environment whereby the CVS came to be viewed as a failure for the system to adapt to the environment.⁴⁷ The excitation/inhibition perspective was coupled to the zone therapy models developed by Riley, which evolved into several of the reflex systems whereby light contacts to the spine led to systemic spinal and neurophysiological changes.⁷⁹

By the 1920s, chiropractors had been testing D. D. Palmer's paradigm in teaching, model building, rudimentary research, and applied clinical application for more than 2 decades.^{3,5,20,80,81} This led to a sophisticated view of the living system, one that was congruent with the way the organismic biologists of the 1920s were also describing life. Biologists were searching for answers that distinguished biology from physics and chemistry. Organismic biologists sought to define biology as the organizing relationships amongst the parts.⁸²⁻⁸⁴

Stephenson's use of the term *organization* was congruent with the way the term was used by the organismic biologists of the 1920s.⁷⁷ In 1927, R. W. Stephenson wrote, "Then what is Innate Intelligence? Scientifically, it is the Law of Organization. (This is by no means a view of the physicists but is squarely in Chiropractic.)"⁸⁵ Biologists and chiropractors of the 1920s used the term *organization* in the same way that dynamical systems theorists and complexity theorists use the term *self-organization* today.^{77,86} The chiropractic paradigm developed alongside twentieth-century theoretical biology.⁷⁶ By integrating this observation from history, new avenues of empirical research may be designed to study the ways the CVS and its correction might relate to the self-organization of living systems.

Differentiation of Innate Intelligence. Stephenson's differentiation of innate intelligence as the law of organization was a new distinction within the chiropractic paradigm and in

relation to CVS theory. He wrote, "Innate Intelligence, the law of organization, continually coordinates the forces and materials within the organism to keep it actively organized."⁸⁵ Stephenson emphasized the biological organizational level of the living system. Stephenson's text was required reading at PSC for many decades. The impact of his text is difficult to overestimate because, in the first 75 years of the chiropractic profession, 75% of chiropractors graduated from PSC.⁸⁷

Stephenson's distinction may have been the first differentiation within the profession of the biological elements from the spiritual elements of the original definitions of innate intelligence. Before this, the term *innate intelligence* was used by the Palmers and their students to depict several different ontological levels or categories of being, from soul to spirit as well as from basic biological organization to healthy function.^{31,88-91}

D. D. Palmer first used the term *innate intelligence* in 1902 and 1903 to describe how the biological system adapts to the environment such as bony changes to stressors like the development of osteophytes.^{90,92} He first used the term *intelligence* in 1872⁹³ as a synonym for "spirit" leaving the body during Mesmeric trance. Thus his first use of *intelligence* was part of a description of his own subjective experiences associated with his spiritualist belief system and early magnetic healing practices. It was not until 1905 that D. D. Palmer officially linked the term *innate intelligence* to the spiritual levels of being. That is, he used the same term to define different levels of being—biological, organizational, and spiritual.⁹¹ Neither of the Palmers ever fully differentiated these ontological levels within the terminology.^{31,89,94}

More recent perspectives have developed from Stephenson's differentiation by proposing that CVS could be viewed apart from the psychospiritual levels of the original innate intelligence definition.^{72,77,95} From this perspective, the role of CVS in limiting the organism's ability to adapt and further self-organize becomes the central focus of the profession. This approach allows for a focus on chiropractic's *raison d'être* without delving into the complex definitions the Palmers associated with innate intelligence. This shift in terminology around the meanings of innate intelligence emphasizes the biological and physiological expressions of health, which are congruent with other CVS definitions of the era and in alignment with salutogenic orientations.⁹⁶⁻⁹⁹

The CVS definition originating from the PSC line of theory could now be discussed apart from the spiritual connotations that D. D. Palmer attributed to innate intelligence.^{73,100-102} This is important because other CVS theorists also developed models during this period, all of which were distinct from the Palmer's philosophical language.^{7,9,20,103,104} When CVS theory is compared with spiritual and philosophical theories, these differentiations and alternate terminologies are rarely cited.¹⁰⁵⁻¹⁰⁷ These distinctions are often missed in the literature for various professional and intraprofessional reasons.¹⁰⁸

Cognitive Dissonance. There is a trend in the literature that uses terms like *cognitive dissonance* in attempts to understand how chiropractors might reconcile CVS theory with evidence-based practice.¹⁰⁹ The assumptions in that argument are that all CVS definitions must contain a nonlogical element because of the traditional definitions.

Cognitive dissonance might be one way to explain how an individual deals with undifferentiated levels of being defined by the same term.¹¹⁰ However, by separating the definition of innate intelligence and emphasizing the biological definitions in relation to CVS, this conflict is resolved. It may even establish a way to reintroduce psychospiritual aspects of health and well-being into the theory,⁷⁷ which would develop chiropractic theory more in line with D. D. Palmer's wider paradigm.¹¹¹

Many complementary and alternative medicine (CAM) theories include psychospiritual and energetic dimensions of health. Micozzi¹¹² suggests that cognitive dissonance shows up as a double standard when science proves the efficacy of some of these methods. Micozzi wrote¹¹²:

Cognitive dissonance for biomedicine leads to a great deal of thrashing about in an attempt to fit empirical observations into places where they cannot go, such as interpreting the vast diversity of healing phenomena routinely observed clinically and increasingly demonstrated scientifically.

It seems that early chiropractors were trying to answer complicated questions about health, healing, and well-being. Diverse research methodologies are needed to explore all of their hypotheses (Fig 11).^{113,114}

Theory Distinctions and Confusions. This section will discuss what I perceive to be misunderstandings in the literature about distinctions made by the theorists in this period of 1916-1927^{5-8,21,85,115} and address such distinctions discussed in the literature for at least 2 decades.^{72,116-118} I will attempt to clarify between the Palmer definitions and other theories. I feel that it is important to avoid associating psychospiritual definitions to all CVS theorists.

The Murphy et al¹⁰⁷ critique of CVS focused on a 1902 compression model linked to D. D. Palmer's biopsychospiritual definition of innate intelligence. In their arguments, they did not include the complex literature on CVS that developed afterward. Instead, they built an argument for firing faculty from chiropractic colleges if they teach the chiropractic paradigm based on D. D. Palmer's models. Murphy et al wrote¹⁰⁷:

One of the problems that we encounter frequently in our interaction with chiropractic educational institutions is the perpetuation of dogma and unfounded claims. Examples include the concept of spinal subluxation as the cause of a variety of internal diseases and the metaphysical, pseudo-religious idea of "innate intelligence" flowing through spinal nerves, with spinal

subluxations impeding this flow. These concepts are lacking in a scientific foundation and should not be permitted to be taught at our chiropractic institutions as part of the standard curriculum. Much of what is passed off as "chiropractic philosophy" is simply dogma, or untested (and, in some cases, untestable) theories which have no place in an institution of higher learning, except perhaps in an historical context.

The references they cite to support that statement have not been subjected to critical analysis in the literature.¹¹⁹⁻¹²² Furthermore, there are no distinctions being made between dogma, metaphysics, CVS theory, or the body's inherent self-organizing capacity.^{73,101} No primary historical references were used to support their conclusions.¹⁰⁷

They also stated¹⁰⁷:

Faculty members who hold to and teach these belief systems should be replaced by instructors who are knowledgeable in the evidence-based approach to spine care and have adequate critical thinking skills that they can pass on to students directly, as well as through teaching by example in the clinic.

There are several areas in their argument that I disagree with. One is that they did not demonstrate knowledge of the recent literature on the topic. Another is that they did not recognize that many different CVS theories have evolved that do not rely on the Palmer's philosophical language. Finally, their references do not represent the decades of CVS theory that arose from clinical and empirical research or the differentiations described earlier that started during 1916-1927.

There are several initiatives in the profession today focused on bringing an evidence-based approach into the classroom.¹²³⁻¹²⁵ One goal of teaching students evidence-based practice is so that they might learn about the different types of scientific evidence.¹²⁶ And yet there is no indication from these initiatives that an inclusion of evidence for CVS, such as clinical studies, case studies, and other forms of research, are being used, even though these form the basis of modern theory and practice. A balanced approach would be to embrace the type of pluralism advocated by Kaptchuk and Miller regarding integrating divergent epistemological approaches in health care.¹²⁷ This type of critical stance toward evidence-based practice coupled with an inclusive pluralism is important especially with regard to Villanueva-Russell's sociological assessment. She theorizes that a few academics in the chiropractic profession are attempting to control the profession's identity by using adherence to scientific standards as a rubric, engaging in "lexicon cleansing," and using the academic publications as a tool to achieve their goals.¹²⁸

Not many current CVS theories still conflate philosophy, spirituality, and biological systems. If some do, they should use appropriate philosophical and methodological tools to distinguish between ontological levels, epistemological perspectives, and biopsychosocial research.^{77,108,129}

Methodological Families	Examples of Methodologies
Phenomenology	<ul style="list-style-type: none"> Ways for individuals to systematically view subjectivity in relation to direct experience: Husserlian phenomenology, introspection, meditation, and contemplation.
Structuralism	<ul style="list-style-type: none"> Ways to objectively research the individual's internal experience such as quality of life, self development, and other patterns of direct experience that are recurring.
Autopoiesis	<ul style="list-style-type: none"> Ways to study the inherent self-organizing processes of the body: cognitive science, self-organizing systems, complex systems, and dynamical physiology.
Empiricism	<ul style="list-style-type: none"> Ways to research observable behaviors: anatomy, physiology, pathophysiology.
Hermeneutics	<ul style="list-style-type: none"> Ways to research intersubjective understanding: medical anthropology, meaning across cultures.
Ethnomethodology	<ul style="list-style-type: none"> Ways to study the intersubjective domains related to these ideas in the culture at large and within the chiropractic culture: semiology, genealogy, cultural studies, poststructuralism, and semiotics.
Social Autopoiesis	<ul style="list-style-type: none"> Ways to research self-regulating systems: how the social system within the society or within the profession shape practices and interactions.
Systems Theory	<ul style="list-style-type: none"> Ways to research the chiropractic profession and various aspects of the profession such as private offices and colleges within social and economic forces.

Fig 11. Eight methodological approaches that could be applied to researching the complexity associated with the many definitions of innate intelligence and subluxation.

I feel that one of the biggest challenges to exploring the history of CVS theory is to make adequate distinctions among philosophy, scientific theory, and hypothesis. By doing so, we may be better able to assess research programs. Viable theoretical models from the past might be used as starting points for future research, but first we need to understand it. Rather than dismissing theory from the past outright,¹³⁰ which may be due to misunderstandings and misinterpretations, we should master it, study how it evolved, and contrast prior theory with current theory and research. Only then can we be sure that all of the hypotheses about CVS have been tested.

Limitations

This article reflects one person's interpretation of historical writings and theories. Future reviews of the literature should include more systematic methods. Without detailed search parameters, inclusion and exclusion criteria, synthesis methods, a standard critical appraisal of the literature reviewed, and evaluation of bias, it is acknowledged that conclusions do need to be made with caution. A strength of this work is that it includes new insights into the history of the chiropractic vertebral subluxation based on primary and

secondary sources, many of which have not been included in previous works. However, this research is limited by the writings that are currently available.

CONCLUSIONS

The chiropractic literature between 1916 and 1927 proposed new theories about living systems in relation to CVS. Theorists from that period viewed the body as a dynamically organized biological system. The role of the central nervous system was to adapt to the environment, centralize the self-organizing processes, and heal from various pathophysiological processes. The central chiropractic paradigm was that CVS impinged on the nervous system, which disrupted the inherent organizing capacity of the organism, leading to "dis-ease" and disease processes.

Chiropractic subluxation theory and its many methods of detection multiplied during this period. Acute and mild CVS were described and expanded on. Different types of chronic CVS were described. The vertemere cycle was developed to explain why CVS are self-perpetuating. Reflex zones were related to CVS for the first time by linking zone therapy's meridian theories to inhibition and excitation cycles. The CVS

in relation to cord pressures took on a new complexity both anatomically and clinically. Understanding the process of correction over time as a result of momentum and retracing also took on new dimensions. The CVS was situated in a much wider context in relation to the organism's adaptation to the environment. All these new insights added to the complexity of the concept and further proposed CVS as the basis of the chiropractic profession.

ACKNOWLEDGMENTS

The author acknowledges Brian McAulay, DC, PhD, David Russell, DC, Stevan Walton, DC, and the Tom and Mae Bahan Library at Sherman College of Chiropractic for their assistance.

FUNDING SOURCES AND CONFLICTS OF INTEREST

The author received funding from the Association for Reorganizational Healing Practice and the International Chiropractic Pediatric Association for writing this series of papers. No conflicts of interest were reported for this study.

CONTRIBUTORSHIP

Concept development (provided idea for the research): S.A.S.

Design (planned the methods to generate the results): S.A.S.

Supervision (provided oversight, responsible for organization and implementation, writing of the manuscript): S.A.S.

Data collection/processing (responsible for experiments, patient management, organization, or reporting data): S.A.S.

Analysis/interpretation (responsible for statistical analysis, evaluation, and presentation of the results): S.A.S.

Literature search (performed the literature search): S.A.S.

Writing (responsible for writing a substantive part of the manuscript): S.A.S.

Critical review (revised manuscript for intellectual content, this does not relate to spelling and grammar checking): S.A.S.

Practical Applications

- This series of articles provides an interpretation of the history and development of chiropractic vertebral subluxation theories.
- This series aims to assist modern chiropractors to interpret the literature and develop new research plans.

REFERENCES

1. Palmer BJ, Craven J. *The Philosophy of Chiropractic*. 2nd ed., Vol. 5 Davenport, IA: Palmer College of Chiropractic; 1916.
2. Palmer BJ. *The Science of Chiropractic: Its Principles and Philosophies*. 3rd ed., Vol. 2 Davenport, IA: Palmer School of Chiropractic; 1917.
3. Palmer BJ. *A Textbook on the Palmer Technique of Chiropractic*. Vol. 13 Davenport, IA: Palmer School of Chiropractic; 1920.
4. Stephenson R. *Chiropractic Textbook*. Vol. 14 Davenport, IA: Palmer School of Chiropractic; 1927.
5. Drain J. *Chiropractic Thoughts*. San Antonio, TX: Alumni Association of the Texas Chiropractic College; 1927.
6. Craven JH. *A Textbook on Chiropractic Orthopedy*. Davenport, IA: Palmer School of Chiropractic; 1921.
7. Carver W. *Carver's Chiropractic Analysis of Chiropractic Principles: As Applied to Pathology, Relatology, Symptomology and Diagnosis*. East Aurora, NY: Carver; 1922.
8. Forster A. *The White Mark: An Editorial History of Chiropractic*. Chicago, IL: National Publishing Association; 1921.
9. Riley S. *Science and Practice of Chiropractic with Allied Sciences*. Washington, D.C.: J.S. Riley; 1919.
10. Keating J, Callender A, Cleveland CA. *History of Chiropractic Education in North America*. Rock Island, IL: Association for the History of Chiropractic; 1998.
11. Nash J. In the eye of the storm: Dossa Dixon Evins and the neurocalometer debacle. *Chiropr Hist*. 1995;15(1):23-26.
12. Craven JH. Interference. *Chiropractor*. 1925;21(12):35, 43.
13. Riley S. *Conquering Units: Or the Mastery of Disease*. Washington, D.C.: J.S. Riley; 1921.
14. Loban J. *Technic and Practice of Chiropractic*. 3rd ed. Denver, CO: Loban Publishing Company; 1920.
15. Riley JS. *Zone Therapy Simplified: All Its Applications Made Plain and Simple for Use by Any One*. Washington, D.C.: J.S. Riley; 1917.
16. Firth J. *Chiropractic Technique Notes: As Compiled from the Lectures of Dr. James N. Firth*. Indianapolis, IN: Lincoln Chiropractic College; 1941.
17. Amman M. A profession seeking clinical competency: the role of the Gonstead chiropractic technique. *Chiropr Hist*. 2008;28(2):81-91.
18. Watkins RJ, Greenshields C, Lee H, Wynn R, Homewood AE. *A Text-book of Chiropractic Technique*. Toronto, ON: Canadian Memorial Chiropractic College; 1948.
19. Palmer BJ. The hour has struck. Eighth Annual P.S.C. Lyceum; August 24, 1924; Davenport, IA; 1924.
20. Forster A. *Principles and Practice of Chiropractic*. 3rd ed. Chicago, IL: The National Publishing Association; 1923.
21. Carver W. *History of Chiropractic*. Phoenix, AZ: National Institute of Chiropractic Research; 2002.
22. Palmer DD. Letter to B.J. Palmer. In: Faulkner T. *The Chiropractor's Protégé: The Untold Story of Oakley G. Smith's Journey with D.D. Palmer in Chiropractic's Founding Years*. Rock Island, IL: Association for the History of Chiropractic; 2017:102.
23. Palmer BJ. *The Science of Chiropractic: Causes Localized*. Vol. 4 Davenport, IA: Palmer School of Chiropractic; 1908.
24. Peters R. *An Early History of Chiropractic: The Palmers and Australia*. Asheville, NC: Integral Altitude; 2014.
25. Keating J. *Chronology of the Neurocalometer*. Davenport, IA: National Institute of Chiropractic Research; 2003.
26. Weiant C, Adelman G. Photography through the skin proves chiropractic a science. *J Natl Chiropr Assoc*. 1952.
27. Keating J. *Chronology of Clarence Wolsey Weiant, D.C., Ph.D.* Los Angeles, CA: Los Angeles College of Chiropractic; 1998.

28. Kyneur J, Bolton S. Lost technology: the rise and fall of chiropractic instrumentation. *Chiropr Hist*. 1992;12(1):31-35.
29. Craven JH. Chiropractic philosophy: mental. *Chiropractor*. 1914;10(7):7-8.
30. Craven JH. *A Text-book on Hygiene and Pediatrics from a Chiropractic Standpoint*. Vol. 3. Davenport, IA: Craven; 1924.
31. Palmer DD. *The Science, Art, and Philosophy of Chiropractic*. Portland, OR: Portland Printing House; 1910.
32. Palmer BJ. *Philosophy of Chiropractic*. 1st ed., Vol. 5 Davenport, IA: Palmer School of Chiropractic; 1909.
33. Craven JH. Life. *Chiropractor*. 1920;16(2):18-22.
34. Palmer BJ. *The Philosophy and Principles of Chiropractic Adjustments: A Series of Thirty-Eight lectures*. 2nd ed. Vol. 3 Davenport, IA: Palmer College; 1911.
35. Primrose A. Compression of spinal cord causing paraplegia and its surgical treatment. *JAMA*. 1910;55(17):1434-1438.
36. Wardwell W. *Chiropractic: History and Evolution of a New Profession*. St. Louis, MO: Mosby; 1992.
37. Davis AP. *Neuropathy: The New Science of Drugless Healing Amply Illustrated and Explained Embracing Ophthalmology, Osteopathy, Chiropractic Science, Suggestive Therapeutics, Magnetism, Instructions on Diet, Deep Breathing, Bathing etc*. Cincinnati, OH: F.L. Rowe; 1909.
38. Abrams A. *Spondylotherapy: Spinal Concussion and the Application of Other Methods to the Spine in the Treatment of Disease*. San Francisco, CA: Philopolis Press; 1912.
39. Gregory AS. *Rational Therapy: A Manual of Rational Therapy Methods*. Oklahoma City, OK: Palmer-Gregory College; 1913.
40. Fitzgerald WH, Bowers EF. *Zone Therapy*. Hartford, CT: M.C. Hillery; 1919.
41. Catalogue of Copyright Entries. Washington, D.C.: Library of Congress Copyright Office: Government Printing Office; 1917.
42. International Institute of Reflexology. History of reflexology. Available at: <http://www.reflexology-usa.net/history.htm>. Accessed October 7, 2016.
43. Drain JR. We Walk Again. Spears Papers. Kansas City, MO: Cleveland College Archives; 1956.
44. Drain JR. *Why Majors Change*. Indianapolis, IN: Chiropractic Research and Review Service; 1926.
45. Palmer BJ. *The Philosophy and Principles of Chiropractic Adjustments: A Series of Twenty-Four Lectures*. Vol. 3 Davenport, IA: Palmer School of Chiropractic; 1908.
46. Stephenson R. Chiropractic fundamentals. *Chiropractor*. 1924; 20(10).
47. Senzon S. Chiropractic and systems science. *Chiropr Dialogues*. 2015;9-20.
48. Senzon S. Chiropractic and energy medicine: a shared history. *J Chiropr Humanit*. 2008;15:27-54.
49. Breig A. *Adverse Mechanical Tension in the Central Nervous System: an Analysis of Cause and Effect: Relief by Functional Neurosurgery*. Stockholm, Sweden: Almqvist & Wiksell International; 1978.
50. Pontell M, Scali F, Marshall E, Enix D. The oblique capitis inferior myodural bridge. *Clin Anat*. 2013;26(4):450-454.
51. Taubenberger JK, Morens DM. 1918 Influenza: the mother of all pandemics. *Rev Biomed*. 2006;17:69-79.
52. Verner J. *The Science and Logic of Chiropractic*. 8th ed. Brooklyn, NY: Dr. P.J. Cerasoli; 1956.
53. Homewood AE. *The Neurodynamics of the Vertebral Subluxation*. 3rd ed. St. Petersburg, FL: Valkyrie Press; 1981.
54. Walton S. *The Complete Chiropractor: RJ Watkins, DC, PhC, FICC, DACBR*. Asheville, NC: The Institute Chiropractic; 2017.
55. Muller RO. *Autonomics in Chiropractic: The Control of Autonomic Imbalance*. Toronto, ON, Canada: The Chiro Publishing Company; 1954.
56. Faye LJ. L. John Faye articles: 1996-1999. *Dyn Chiropr*. 1999.
57. Gatterman M. *Foundations of Chiropractic Subluxation*. St. Louis, MO: Mosby; 1995.
58. Palmer BJ. *The Philosophy, Science, and Art of Chiropractic Nerve Tracing: A Book of Four Sections*. Vol. 6 Davenport, IA: Palmer School of Chiropractic; 1911.
59. Palmer BJ. *The Subluxation Specific the Adjustment Specific*. Vol. 18 Davenport, IA: Palmer School of Chiropractic; 1934.
60. Palmer BJ. *Clinical controlled chiropractic research*. Vol. 25 Davenport, IA: Palmer School of Chiropractic; 1951.
61. Palmer BJ. Disciplining the hour. *Chiropractor*. 1933;30(2):6.
62. Harper W. *Anything Can Cause Anything: A Correlation of Dr. Daniel David Palmer's Principles of Chiropractic*. Pasadena, TX: Texas Chiropractic College; 1997.
63. McEwen BS, Wingfield JC. What's in a name? Integrating homeostasis, allostasis and stress. *Horm Behav*. 2010;57 (2):105.
64. Donofrio J. Incorporating salutogenesis in a new chiropractic paradigm. Paper presented at: 9th Annual International Research and Philosophy Symposium. October 20-21, 2012. TN: Sherman College of Chiropractic, Spartanburg; 2012.
65. Hurley J, Sanders H. *Aquarian Age Healing for You*. Los Angeles, CA: Haynes Corporation; 1932.
66. Logan H. *Logan Universal Health Basic Technique*. St. Louis, MO: Logan; 1931.
67. De Jarnette B. *Sacro Occipital Technic*. Nebraska City, NE: DeJarnette; 1933.
68. Cleveland C. *Chiropractic Analysis: Symptomatology Outline*. Kansas City, MO: Cleveland Chiropractic College; 1951.
69. Keating J, Mootz R. Five contributions to a philosophy of the science of chiropractic. *JMPT*. 1987;10(1):25-29.
70. Clusserath M. Vertebral subluxation and a professional objective for chiropractic. *J Chiropr Humanit*. 1999;9:9-20.
71. Lantz C. Vertebral subluxation chiropractic. *Top Clin Chiropr*. 1995;2(2):1-10.
72. Strauss J. *Refined by Fire: The Evolution of Straight Chiropractic*. Levittown, PA: Foundation for the Advancement of Chiropractic Education; 1994.
73. Senzon S. Constructing a philosophy of chiropractic: when worldviews evolve and postmodern core. *J Chiropr Humanit*. 2011;18(1):39-63.
74. Gaucher-Peslherbe P. *Chiropractic: Early Concepts in Their Historical Setting*. Chicago, IL: National College of Chiropractic; 1993.
75. Callender A. The mechanistic/vitalistic dualism of chiropractic and general systems theory: Daniel D. Palmer and Ludwig von Bertalanffy. *J Chiropr Humanit*. 2007;14:1-21.
76. Senzon S. What is life? *J Vert Sublux Res*. 2003;13:1-4.
77. Senzon S. Causation related to self-organization and health related quality of life expression based on the vertebral subluxation model, the philosophy of chiropractic, and the new biology. *J Vert Sublux Res*. 1999;3:104-112.
78. Senzon S. The theory of chiropractic pattern analysis and the new biology. Paper presented at: Eighth Annual Vertebral Subluxation Conference. October 2000. Spartanburg, TN: Sherman College; 2000.
79. Senzon S. *The subluxation model. International Research and Philosophy Symposium. October 10-11, 2015*. Spartanburg, TN: Sherman College; 2015.
80. Swanberg H. *The Intervertebral Foramina in Man: The Morphology of the Intervertebral Foramina in Man, Including a Description of Their Contents and Adjacent Parts, with Special Reference to the Nervous Structures*. Chicago, IL: Chicago Scientific Publishing; 1915.
81. Firth J. *A Text-book on Chiropractic Symptomatology: Or, the Manifestations of Incoordination Considered From a*

- Chiropractic Standpoint*. Vol. 7. Davenport, IA: Palmer College of Chiropractic; 1914.
82. Smuts J. *Holism and Evolution*. New York, NY: Macmillan Co.; 1926.
 83. Whitehead AN. *Process and Reality: An Essay in Cosmology; Gifford Lectures Delivered in the University of Edinburgh During the Session 1927-28*. New York, NY: The Macmillan Co.; 1929.
 84. Morgan C. *Emergent Evolution: The Gifford Lectures, Delivered in the University of St. Andrews in the Year 1922*. London, UK: Williams and Norgate; 1923.
 85. Stephenson R. *Chiropractic Textbook*. 2nd ed. Davenport, IA: Palmer School of Chiropractic; 1940.
 86. Capra F. *The Web of Life: A New Scientific Understanding of Living Systems*. New York, NY: Anchor Books; 1996.
 87. Keating J. B.J. *of Davenport: The Early Years of Chiropractic*. Davenport, IA: Association for the History of Chiropractic; 1997.
 88. Senzon S. An integral approach to unifying the philosophy of chiropractic: B.J. Palmer's model of consciousness. *J Integral Stud*. 2000;1(2).
 89. Palmer BJ. *The Bigness of the Fellow Within*. Vol. 22. Davenport, IA: Palmer School of Chiropractic; 1949.
 90. Palmer DD. *Innate Intelligence*. Davenport, IA: Palmer Infirmary and Chiropractic Institute; 1903.
 91. Palmer DD. Immortality. *Chiropractor*. 1906;2(3):14-16.
 92. Palmer DD. *Is chiropractic an experiment?* The Davenport Times; June 14, 1902.
 93. Palmer DD. Letter to the editor. *Religio-Philos J*. 1872;12(16):6.
 94. Palmer DD, Palmer BJ. *The Science of Chiropractic*. Davenport, IA: The Palmer School of Chiropractic; 1906.
 95. Gold R. The third paradigm. Available at: Chiroweb.com 2000.
 96. Gold R. *Triune of Life*. 2nd ed. Spartanburg, TN: Sherman College of Straight Chiropractic; 1998.
 97. Watkins RJ. Subluxation terminology since 1746. *J Am Chiropr Assoc*. 1968. In: Walton S. *The Complete Chiropractor: RJ Watkins, DC, PhC, FICC, DACBR*. Asheville, NC: The Institute Chiropractic; 2017:271-279.
 98. Bittner H, Harper W, Homewood A, Janse J, Weiant C. Chiropractic of today. *ACA J Chiropr*. 1973;VII(S-81-S-88).
 99. Antonovsky A. *Health, Stress, and Coping*. San Francisco, CA: Jossey-Bass; 1979.
 100. Senzon S. Constructing a philosophy of chiropractic: when worldviews evolve and modern foundation. *J Chiropr Humanit*. 2011;18(1):24-38.
 101. Senzon S. Constructing a philosophy of chiropractic: when worldviews evolve and premodern roots. *J Chiropr Humanit*. 2011;18(1):10-23.
 102. Senzon S. B.J. Palmer: an integral biography. *J Integral Theory Pract*. 2010;5(3):118-136.
 103. Ratledge T. *The Philosophy of Chiropractic*. Los Angeles, CA: Ratledge; 1949.
 104. Loban J. *A Textbook of Neurology: Arranged for the Classroom and for Ready Reference by the Practitioner*. Denver, CO: Bunn-Loban Publishing; 1929.
 105. Keating J. The meanings of innate. *J Can Chiropr Assoc*. 2002; 46(1):4-10.
 106. Leach R, Phillips R. *Philosophy: Foundation for Theory Development*. 4th ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2004.
 107. Murphy D, Schneider M, Seaman D, Perle S, Nelson C. How can chiropractic become a respected mainstream profession? The example of podiatry. *Chiropr Osteopath*. 2008;16:10.
 108. Senzon S. Chiropractic professionalism and accreditation: An exploration of conflicting worldviews through the lens of developmental structuralism. *J Chiropr Humanit*. 2014;21(1): 25-48.
 109. Glied J, Hawk C, Anderson M, et al. Chiropractic identity, role and future: a survey of North American chiropractic students. *Chiropr Man Therap*. 2015;23(1):4.
 110. Festinger L. *A theory of Cognitive Dissonance*. Vol. 2 Redwood City, CA: Stanford University Press; 1962.
 111. Palmer DD. *The Chiropractor*. Los Angeles, CA: Press of Beacon Light Printing Company; 1914.
 112. Micozzi M. Double standards and double jeopardy for CAM research. *J Altern Complement Med*. 2001;7(1):13-14.
 113. Rosner A. Evidence-based medicine: revisiting the pyramid of priorities. *J Bodyw Mov Ther*. 2012;16(1):42-49.
 114. Esbjörn-Hargens S. Integral research: A multi-method approach to investigating phenomena. *Constructivism Hum Sci*. 2006;2 (1):79-107.
 115. Nixon J. *The Spirit of the P.S.C.: A Story Based on Facts Gleaned at the Chiropractic Fountain Head*. Vol. 14. Davenport, IA: Palmer College of Chiropractic; 1920.
 116. McAulay B. Neo-institutionalization and professional socialization: the medicalization of "regular" chiropractic. *J Straight Chiropr*. 1995;1:1-7.
 117. Boone W, Dobson G. A proposed vertebral subluxation model reflecting traditional concepts and recent advances in health and science. *J Vert Sublux Res*. 1996;1:19-36.
 118. Gelardi T. The science of identifying professions as applied to chiropractic. *J Chiropr Humanit*. 1996;6:11-17.
 119. Keating J, Charton K, Grod J, Perle S, Sikorski D, Winterstein J. Subluxation: dogma or science. *Chiropr Osteopath*. 2005;13:17.
 120. Mirtz TA. The question of theology for chiropractic: a theological study of chiropractic's prime tenets. *J Chiropr Humanit*. 2001;10:48-82.
 121. Mirtz T. Universal intelligence. *J Chiropr Humanit*. 1999;9: 55-71.
 122. Seaman D. Philosophy and science versus dogmatism in the practice of chiropractic. *J Chiropr Humanit*. 1998;8:55-66.
 123. Long CR, Ackerman DL, Hammerschlag R, et al. Faculty development initiatives to advance research literacy and evidence-based practice at CAM academic institutions. *J Altern Complement Med*. 2014;20(7):563-570.
 124. Haas M, Leo M, Peterson D, LeFebvre R, Vavrek D. Evaluation of the effects of an evidence-based practice curriculum on knowledge, attitudes, and self-assessed skills and behaviors in chiropractic students. *J Manipulative Physiol Ther*. 2012;35(9): 701-709.
 125. Evans R, Maiers M, Delagran L, Kreitzer MJ, Sierpina V. Evidence informed practice as the catalyst for culture change in CAM. *Explore (NY)*. 2012;8(1):68.
 126. Kreitzer MJ, Sierpina VS. NCCAM awards grants to CAM institutions to enhance research education. *Explore (NY)*. 2008;4 (1):74-76.
 127. Kaptchuk TJ, Miller FG. What is the best and most ethical model for the relationship between mainstream and alternative medicine: opposition, integration, or pluralism? *Acad Med*. 2005;80(3):286-290.
 128. Villanueva-Russell Y. Caught in the crosshairs: Identity and cultural authority within chiropractic. *Soc Sci Med*. 2011;72 (11):1826-1837.
 129. Senzon S. Constructing a philosophy of chiropractic I: an integral map of the territory. *J Chiropr Humanit*. 2010;17(17): 6-21.
 130. McAulay B. Rigor in the philosophy of chiropractic: beyond the dismissivism/authoritarian polemic. *J Chiropr Humanit*. 2005; 12:16-32.

The Chiropractic Vertebral Subluxation

Part 5: The First Research Era From 1928 to 1949



Simon A. Senzon, MA, DC

ABSTRACT

Objective: The purpose of this paper is to review and discuss the history of chiropractic vertebral subluxation theories between 1928 and 1949.

Discussion: Theories during this period grew in complexity and developed in 4 primary ways: upper cervical models, reflex models, global models, and models based on the work of Speransky. Authors, theorists, and technique developers during this time included B. J. Palmer, R. J. Watkins, Galen Price, John Hurley, Hugh Logan, Major Bertrand DeJarnette, Richard Van Rumpft, Roy Ashton, Joseph Janse, Henri Gillet, James Firth, and J. R. Verner. At least 8 perspectives on chiropractic vertebral subluxation were advanced through research, modeling, and applied clinical methods. By understanding the complexity of this period and analyzing the research, the modern practitioner will be able to appreciate this era. The foundations of modern clinical practice and theoretical applications have roots in this period.

Conclusion: Theories during this period developed in levels of complexity, expanding existing models and clinical practice methods. The theories and research from this period had an effect on the chiropractic profession for the subsequent decades. (J Chiropr Humanit 2018;25C:67-85)

Key Indexing Terms: *Chiropractic; History*

INTRODUCTION

Several new chiropractic vertebral subluxation (CVS) models emerged in the chiropractic profession between 1928 and 1948. Theories during this era were developed through instrumentation,¹⁻⁵ clinical practice,⁶⁻⁸ clinical research,^{1,9-11} model building,^{2,5,12-17} and increasing sophistication of neurophysiological models.¹⁸⁻²¹ According to Martin, the use of science in chiropractic was driven by at least 3 forces, including a revolt against the authority of medicine, the need to upgrade and reform chiropractic educational standards, and the development of new research strategies.²²

Martin suggested that chiropractic research in this period, although paltry in comparison to conventional clinical science, was not very different from the latter.²² He estimated that 51% of the articles published in the first 6 months of the 1935 volume of the *Journal of the American Medical Association* lacked experimental design. Similar statistics were found for the *Journal of Clinical Investigation* during

that time.²² Therefore, chiropractic research from this era should be viewed in this context.

Some of the leading CVS theorists reportedly conducted research during this era. Gillet initiated rudimentary interexaminer reliability studies soon after his graduation from Palmer School of Chiropractic (PSC) in 1928.⁵ Logan created the International Chiropractic Research Foundation in 1934, along with some of his followers, including 2 former PSC faculty, E. A. Thompson and John Craven.²³ Ashton conducted clinical evaluations on his myobasal technique in private practice and at the Standard Chiropractic College in New York City from 1923 to 1940.¹⁰ B. J. Palmer's research clinic opened in 1935.¹ Illi founded the Institute for the Study of the Statistics and Dynamics of the Human Body in Geneva in 1943, based on his research started in the 1930s and his collaboration with Joseph Janse at National Chiropractic College.²⁴ Finally, Weiant became director of research of the National Chiropractic Association Bureau of Research in 1929, research director for the National Chiropractic Association in 1944, and head of the Chiropractic Research Foundation (precursor of the Foundation for Chiropractic Education and Research) in 1945 (Fig 1).²⁵

The purpose of this paper is to explore CVS theories during this period, including the various attempts at research inquiries of these models. A critical analysis is also presented pertaining to research claims, validity, how chiropractors have understood and applied historical data, and evidence-based practices.

School of Health and Human Sciences, Southern Cross University, Lismore, New South Wales, Australia.

Corresponding author: Simon A. Senzon, MA, DC, 218 E Chestnut Street, Asheville, NC 28801. Tel: +1 828 251 0815.

(e-mail: Simon@institutechiro.com).

Paper submitted May 18, 2016; accepted May 15, 2018.
1556-3499

© 2018 by National University of Health Sciences.

<https://doi.org/10.1016/j.echu.2018.10.004>

Researcher	Starting Year	Research Topic
Gillet	1930s	Motion Palpation
Logan	1934	Logan Basic Technique
Ashton	1923	Myo-Basal Technique
B.J. Palmer	1935	Upper Cervical Technique
Illi	1930s	Pelvic Biomechanics
Weiant	1930s	Photo-electric subluxation instrumentation

Fig 1. Research efforts during 1928-1949.

Chiropractic Vertebral Subluxation Between 1928 and 1949

There were 4 main developments of CVS theory between 1928 and 1949, including upper cervical models,^{1,2,9,17,26} reflex models,^{6,10,12-14,27} integrative models,^{6,11} and models based on work by Speransky (Speranskian models).^{9,16,19,28} Intertwined models were commonplace, such as Firth's integration of most techniques,⁶ B. J. Palmer's integration of Speransky with his upper-cervical approach,^{1,9} and R. J. Watkins' integration of most models with Speransky and the latest neurophysiology.²⁰

B. J. Palmer's Upper Cervical Models. B. J. Palmer's initial upper-cervical theory was based on 7 years of clinical observations with early thermography and is one of the

contributions during this period.²⁶ In 1951, Palmer published a book that reflected the 14 years of data collection conducted after his first text on upper cervical-specific CVS.^{1,9,17} His theories during this time took on new levels of complexity, including his theories of periodicity and frequency of CVS.^{29,30} His models were further developed during this period by his student Galen Price.² Although B. J. Palmer's later emphasis on upper cervical theory is common knowledge, detailed understanding of his theories are rarely described in the literature (Fig 2).

B. J. Palmer introduced his hole-in-one upper cervical model in an article in 1930 and a talk in 1931.^{1,31} Palmer published 3 texts between 1934 and 1938 as *Volumes 18*,

Year	Hypothesis	Theory Development
1923	Heat associated with vertebral subluxation could now be objectively measured	B.J. Palmer started clinical research with thermographic instrumentation
1925	Chronic and acute subluxations present with different thermographic findings	Craven published the first instrumentation findings
1930	Subluxations with interference to the nervous system only occur in the UC spine, which may be empirically observed as repeated patterns of thermal activity.	After seven years of thermographic research, Hole in One / upper cervical technique introduced
1930	Subluxations no longer need to be corrected daily, weekly, or monthly	Commence systematic testing subluxation theory with thermographic and x-ray analysis
1932	Subluxations remain in the same position until adjusted	First two years of clinical research complete
1933	Subluxation intermittently fluctuates in time and dis-ease has a periodicity based on how often subluxation was present	Clinical research using thermography at the same time every day was conducted for weeks
1934	Subluxations have degree, periodicity, and frequency as well as a field of chronic position, which may cause compensations in the spine	Specific subluxations were determined to return to the same field or "abnormal range"
1936	The interference may be related to the human energy system and be affected by environmental energies such as magnetic waves, radio waves, and static electricity	Research in shielded grounded booths using various instrumentation methods
1938	Speransky and Crile came to the same conclusions as chiropractic that quantity and quality energy flow could be modified by blocking afferent or efferent neural structures	Produced a compendium of clinical research based on thermography and x-ray analysis
1951	No two subluxations are alike	Clinical controlled research compilation from 1935 to 1951 is published

Fig 2. Development of B. J. Palmer's chiropractic vertebral subluxation hypotheses. UC, upper cervical.

19, and 20.^{9,17,26} *Volume 18* was published in 1934 and called *Subluxation Specific Adjustment Specific*. It was his first textbook on upper cervical theory and may have included some theories from A. A. Wernsing, a 1926 PSC graduate.^{26,32}

In 1932, Palmer explained why he switched from a theory related to CVS at any level of the spine to specific upper cervical chiropractic.¹ It was multifaceted reasoning that included his then almost 10 years of thermographic pattern observations and about 40 other observations he appended to Stephenson's 33 principles.^{1,33} Starting in 1930, his method for detecting CVS changed to what he referred to as a more accurate and scientific approach. Palmer writes that as of 1935, "We began to definitely set our minds to determine ways and means; to study, research, locate, and to know WHERE, WHEN, HOW NERVE PRESSURE INTERFERENCE TO TRANSMISSION EXISTED."¹ Thus, he did not change his overall theory, which dated to the period from 1907 to 1911,³⁴⁻³⁶ but he did change his analysis, his regional focus, and his methodology. He still defined CVS in terms of misalignment, occlusion, pressure, and interference.

Palmer developed a new regional focus of CVS. He maintained that the only vertebrae that could subluxate were the upper cervical spine and that vertebra below axis could only misalign, not subluxate, and that it was required in this definition that there must be interference to the transmission of mental impulses. A misalignment was less than a CVS and could have all the signs of what was previously deemed a CVS determined through palpation, spinograph, taut fibers, tender nerves, contracted muscles, and even a peak thermographic reading.¹

One reason for this new approach was the finding that successful adjustments of the sacrum and coccyx were actually adjusting the major CVS in the upper cervical spine. Palmer suggested that it was eventually proved this was due to relief of cord tension,¹ which was developed from his original theory of spinal cord tension.³⁷ B. J. Palmer concluded that CVS could only occur in 3 directions simultaneously or be torqued, which he felt put pressure on the spinal cord.²⁶ This was a change from his 1908 theory that CVS occurred in 6 ways: superior, inferior, left, right, anterior, and posterior.³⁸ This was proposed to be determined with thermographic instrumentation based on a method of pattern analysis coupled with x-ray analysis. In 1934, Palmer wrote:

To 'torque' is to cork-screw in a three direction movement simultaneously. The three directions are: up or down, S or I, to left or right, L or R, around, circularly obliquely, a combination. The average mind can readily understand, see, visualize ONE direction. A lesser number grasp and understand TWO directions. FEW appreciate motion when directed THREE directions simultaneously. 'Torqued subluxations' and 'torqued adjustments' involve THREE directions.²⁶

The first 10 years of neurocalometer (NCM) research at PSC from 1923 to 1933 led directly to the development of

upper cervical-specific chiropractic. By 1936, B. J. Palmer included the neurocalograph, which was a sensitive graph reader that attached to the NCM, and the neurotempometer, which set a standardized speed for NCM readings. Patients were checked and rechecked for days and weeks until the heat pattern returned. When it did, and it was consistent, an adjustment was given.¹ This was the development of what has been called *physiological pattern work* in chiropractic.

Building upon D. D. Palmer's original models,^{36,39} B. J. considered the etiology of CVS as an interplay between the interior and the exterior.¹ When external forces overcome internal resistance, a vertebra may lose its position and go from normal to abnormal. He referred to this as centripetal forces overcoming centrifugal forces.¹ By checking and rechecking patients at the same time of day every day for days, weeks, and months, B. J. Palmer and his staff noted variable patterns and frequencies of CVS. They thought that when a CVS returned it was due to an external force or sudden change in the environment, especially temperature.¹

B. J. Palmer hypothesized that seasonal changes in temperature that were abrupt could cause a change in chemical balance in the body, which could affect the muscle's ability to effectively adapt to and resist the heat or cold. For example, sudden cold exposure could contract the muscles of the neck, which were generally exposed to the cold. The contracted muscles did not allow the body to effectively adapt to a new invading force. The reverse could happen if muscles were too relaxed from heat. This could bring back the major CVS pattern. He recommended chiropractors study this seasonal phenomenon in practice.¹

B. J. Palmer proposed that the CVS causes contracted or relaxed muscles, which change to contracted or prolapsed muscles. Muscles normally contract and take up the shock of an invasive force. They absorb the shock with resistance. The thought was that CVS could occur because the external force was overwhelming or because the resistance was lowered from previous CVS. The lowered resistive force could be abnormal or pathological owing to CVS.¹ B. J. Palmer suggested that health could be better understood by analyzing general bodily resistance. He thought if the body could not resist the invasive force, the force had to be "dissipated in either breaking soft tissue or displacing bones in any one of degrees mentioned,"¹ such as misalignment or CVS. He continued:

Some muscle or sets of muscles somewhere distributed about, over, and in human frame; lowering or increasing of action being symptoms and pathologies of dis-ease. This lack of mental impulse supply lowers tone, introduces more or less permanent contracture or permanent relaxation (prolapse) and makes them less able to resist future invasions of even less strong invasionary forces.¹

B. J. Palmer posited that the range of invasive concussive forces resulting in CVS was less than that required for a

dislocation but more than that needed for a misalignment. He also thought that this could result in a primary CVS occluding a foramen, producing pressure on nerves, and interfering with the transmission of mental impulses, which led to the lowered resistance and lowered tone.¹ This was a contribution to D. D. Palmer's contention that chiropractic is based on tone.³⁶

In 1933, B. J. Palmer gave a talk at the PSC lyceum.¹ He proposed that CVS had frequency, degree, and periodicity. In 1934, he added that CVS roved or roamed around within an "abnormal range."¹ The abnormal range became consistent; therefore, the CVSs were reproduced in the same abnormal position in chronic recurrences. These ideas were published in 1934 in *Volume 18* and later edited and republished in 1951, in *Volume 25*.^{1,26} The 1933 talk was published in the April and May issues of *The Chiropractor*. The first article was titled, "Is there an ebb and tide to subluxation frequency?"^{26,29} The second article was titled, "When is a vertebral subluxation?"³⁰ A third article was cited by B. J. in 1951, as the foundation for the other ideas. It was titled, "What is behind the hoboing, roving, or roaming of vertebral subluxations?"¹ He suggested that without the third article, the ideas on CVS frequency would seem "contradictory."¹

Palmer explained that primary CVS may return in the same vertebral positioning in the future and also cause compensatory misalignments in other areas of the spine. He suggested that CVS weakened muscles, even after the CVSs had been corrected they may come back, but the CVS would stay in an abnormal range. He suggested that each CVS created its own field of effects in the body. He wrote, "Each field is distinct unto itself; each creates its own field of consequent and sequential effects noticeable in body."¹ Recurrence of the same vertebral subluxation pattern may indicate such a field.

Until 1930, the theory purported at PSC was that a CVS needed to be adjusted "daily, regularly, constantly, and continuously for months, until the patient was well."²⁶ A change occurred in the spring of that year when B. J. Palmer and his staff tested this methodology using NCM and spinograph (chiropractic x-ray analysis) readings. By fall 1932, they thought that once a CVS existed it was there 24 hours per day, but after it was adjusted, sometimes with just 1 adjustment, it would stay adjusted. By 1933, however, they concluded that CVS may intermittently fluctuate in time.²⁶

Palmer wrote:

Idea that ONCE A VERTEBRAL SUBLUXATION it exists 24 hours a day must now give way to newer observation that all which is necessary to reduce health of an individual is that it be more or less present more or less of time, which gradually decreases distance of time between, which decreases health time periods and increases disease time periods, effects of which

increase in severity or in periods of time and reduce resistance of tone of tissue structure and thus introduce its opposite or dis-ease of tissue function.¹

B. J. Palmer proposed that the CVS regulated the abnormal supply of mental impulses from the brain based on the degree of CVS.²⁶ "Dis-ease" grew when interference to the transmission was continuous, in multiple locations, and when that interference was present more often than innate intelligence could adapt to or correct it. Getting better or worse depended on how often CVS was present or not. He referred to this as periodicity of "dis-ease," which was directly related to its irregular periodicity. He thought that the degree of CVS was variable.¹ By 1951, Palmer concluded that no matter how meticulously he took records or for how long, there was no set law determining CVS periodicity. In other words, no 2 were alike.¹

Two important ideas from D. D. Palmer's final writings were tone and CVS as a regulator.^{39,40} D. D. Palmer hypothesized that CVS was a regulator of tension via the neuroskeleton. In these writings on periodicity and frequency of CVS, B. J. Palmer described it as a regulator of unnatural and abnormal impulses leading to lowered tone.^{1,26} This may be his only mention of "tone." This information refutes a theory by Keating that B. J. Palmer only used D. D. Palmer's earliest theories.⁴¹

Galen Price was a 1936 graduate of PSC and the dean of chiropractic philosophy from 1961 to 1977.⁴² Price went on to become the interim president of PSC in 1978. In 1940, Price republished Stephenson's text with an added section called "Occipito-Atlanto-Axial Region."² Stephenson was on the faculty while Price was a student.⁴³ Price started his chapter with a B. J. Palmer quotation suggesting that the neurophysiology of CVS was well documented in 263 publications from the medical literature, although he did not provide the references. Price then suggested a new innovative rationale for specific CVS of the upper cervical spine. The new rationale was developed by B. J. Palmer and his colleagues and based in part on statistics; clinical practice in the B. J. Palmer Chiropractic Clinic; B. J. Palmer's latest ideas; and the latest instrumentation technologies designed to detect CVS, such as electroencephaloneuromentimpograph (Fig 3), neurotempometer, conturgrafometer, and a new x-ray analysis technique.²

Price built upon Stephenson's ideas about the functional importance of the antagonistic spinal muscles. Stephenson wrote, "The muscles are employed constantly, especially when there is consciousness. The muscles are the means of subluxations occurring. The response to a concussion is referred to as *innate contraction of forces*."⁴⁴ Price proposed the exact muscles involved in each CVS as a new addition to the Palmer Method of analysis.² For example, atony of 1 muscle pointed to the contracture of its antagonistic "fellow-muscle," which locked the CVS in place. He stated that CVS may result in impingement of the spinal nerve, unbalanced

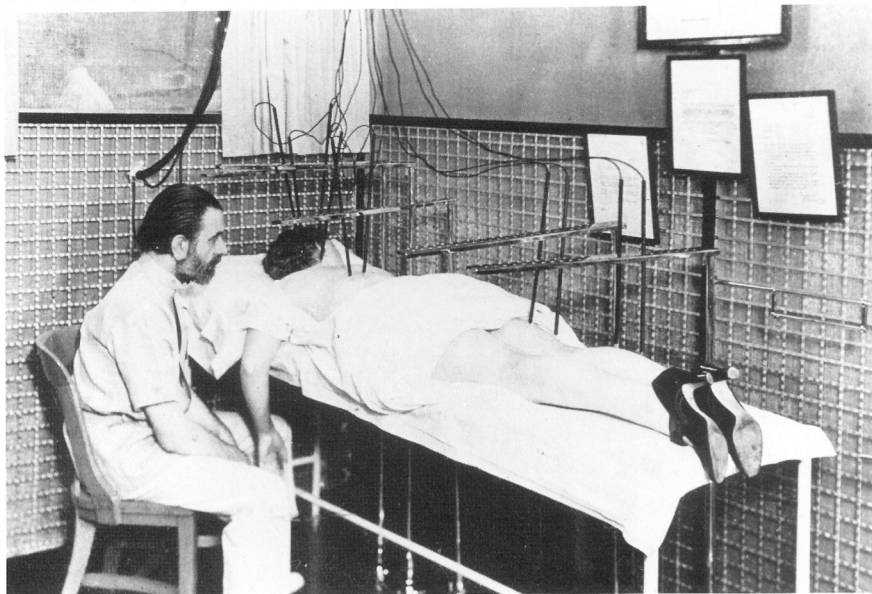


Fig 3. B. J. Palmer with a patient connected to the 8 sensors of the electroencephaloneuromyotomograph in a shielded grounded room lined with copper wiring. (Courtesy of Special Services, Palmer College of Chiropractic.)

tense and tender muscles, pain, misaligned vertebra, tension and tenderness in the region, a thermographic reading (which they thought indicated a hot nerve), or a traceable tenderness, cord pressure below the zone, and incoordination and dis-ease in viscera.²

Price wrote that “dis-ease” was due to “a vertebral subluxation which occludes an opening, impinges nerve channels, and offers interference to transmission of mental impulse supply between brain and body.”² He included the importance of the efferent and afferent nerve fibers in the occipito-atlantoaxial region. Price introduced the following new terminology to describe cord occlusion based upon B. J. Palmer’s models: circumferential constriction, torqued meningeal occlusion, heat expansion meningeal occlusion, and scar tissue occlusion²; each of these terms were included by Palmer in 1952.⁴⁵ Nerve tracing was conducted to determine which zones below the area of cord pressure were affected by the atlas or axis CVS.²

Reflex Models. In 1941, James Firth referred to a class of chiropractic practices as “reflex technics.”⁶ The reflex theories of Hurley,¹² Logan,¹³ DeJarnette,¹⁵ VanRumpt,²⁷ and Ashton shaped many models thereafter.¹⁰ Janse, Houser, and Well’s principles of reflex technics summed up the theories and laid the foundation for further technic and model development.¹⁴ New chiropractic reflex technics and their reflex models emerged during this time. Roots of these theories can be found in several earlier theories.^{39,46-48} These reflex models influenced the profession in significant ways, most of which led to increasingly complex neurological explanations for CVS (Fig 4).^{19,20,49-52}

John Hurley may have graduated from Marchand Chiropractic College in 1916 and PSC in 1918.^{53,54} He was dean of physiology at the California Chiropractic College in 1923. His background was engineering. Early success in his career with very light-force adjusting methods led to a new model.⁵³ Hurley reasoned that the body’s center of gravity

Technic Developer	Subluxation Theory	Analysis
Ashton	Gravitational stress leads to posteriorly rotated innominate, which leads to compensations and subluxations.	Full-spine standing x-ray analysis, palpation, and bilateral scales.
VanRumpt	Combined SOT subluxation model with full spine subluxation approaches as well as any possible nerve interference in the body.	Leg-check challenges to give contact and directional location for thumb-toggle adjustment.
DeJarnette	Innominate subluxation are primary to sacral subluxation, which are related to occipital subluxations, any of which may cause compensations	3 categories are determined using plumb line analysis, palpation, leg checks, pain and other findings
Logan	Anterior and inferior sacrum is primary and rotatory scoliosis as well as full body distortions are secondary.	Standing full-spine x-ray analysis, gluteal crease test, bilateral scales, posture analysis, and palpation.
Hurley	Unlevel sacrum leads to compensatory strains in the rest of the spine in relation to the center of gravity.	Plumb line analysis with standardized footplates to visualize overall spinal distortion with light contact test.

Fig 4. Prominent reflex techniques of the period. SOT, Sacro-Occipital Technique.

was just anterior to the lumbo-sacral junction.¹² He surmised that an unlevelled sacrum led to compensatory strain in the rest of the spine. He developed a device to measure the plumbline in a standing position. His method was a light gluteal contact with vectoring designed to bring the patient's spine closer to the plumbline and alleviate compensatory strain on the tissues. Hurley moved away from language using CVS in his 1932 book, and only used the term *subluxation* 4 times.¹²

Hugh Logan was a 1915 graduate of Loban's Universal Chiropractic College.⁴³ Logan taught for Hurley before 1932 and later developed the work into Logan Basic Method.¹³ In 1933, Logan embraced Sausser's new full-spine x-ray analysis over Hurley's plumbline method of analysis.⁴³ Logan Chiropractic College opened in 1935 in St. Louis, Missouri.²³

In Logan's first explanation of the Basic Technique in 1931, he published a 9-page pamphlet and used the term *subluxation* 22 times.¹³ In his 1950 textbook, Logan used the term 180 times.⁷ Logan's dictum was "as the sacrum goes so goes the spine."⁷ Restoring sacral position was the key to reducing curves, CVS, and disease. The anterior and inferior sacral subluxation was central to his theory.⁷

Logan felt that the body normally self-corrects CVS on its own except when sacral subluxation was present, as the sacrum is the center of gravity. Chronicity and acuteness were dependent upon the tone of the muscles related to the sacral subluxation.⁷

Logan's concept of correction was related to his unique perspective. According to Logan, acute CVS led to radiating tension in the surrounding muscles, "ready to return the sacrum to normal upon application of the slightest force in the proper location and direction, to that direction in which the strained muscles radiate."⁷ This accounted for the "potentiality" of the contact, which was taken at the most strategic point. The light pressure in the direction of the strained muscles led to release of the strain. Logan reasoned that because the CVS was causing the strain, it too should be corrected.

Logan also described the biomechanical and neurological effects of CVS on the organs. He considered that the mechanical disrelationships owing to distortions of the frame and spine, and the lack of transmission of impulses, were due to CVS. He explained that this affects the tone of the organs, muscles, and ligaments.⁷ Logan wrote that a distorted body wasted energy in its attempt to overcome the strain. This abnormal condition and waste of energy was a type of "friction" that would eventually wear the body down. By correcting this condition, the body was able to use its energies for maintenance and its struggles with the environment. As function increased, Logan observed that toxins would dissipate from the system through sweating, yawning, sighing, and increased respiration.⁷

Major Bertrand DeJarnette studied most of the theories of the day. He received a degree in osteopathy in 1922 from the Dearborn College of Osteopathy and a degree in chiropractic in 1924 from the Nebraska Chiropractic College, which was run by the Crabtrees, who were graduates of Carver's school.^{23,55}

In 1930, DeJarnette published his *Vasomotor Control*¹⁸; in 1933, *Sacral-Occipital Technique*¹⁵; and in 1935, *Spinal Distortions*.⁵⁶ DeJarnette combined Logan and Hurley's models with concepts from Frederick Erdman's physiological treatise on controlling vasomotor circulation with manual methods.¹⁸ DeJarnette also modified adjusting methods from Hurley and Logan and combined them with osteopathic maneuvers, diversified type occipital adjustments, and Abrams' spondylotherapy. DeJarnette's sacral-occipital technique included contact points at 5 sacral zones and 7 occipital zones on each side, right and left.¹⁵ Like the other osteopathic and medically oriented chiropractors before him, DeJarnette sought to stimulate or inhibit specific spinal levels.^{48,57}

VanRumpt was a 1923 National School of Chiropractic graduate when Forster and Schultz were secretary and president. VanRumpt was associated with DeJarnette in the 1920s and 1930s. In 1940, he developed the Directional Non-Force Technique, which included the first reactive leg check to determine CVS. Van Rumpt combined DeJarnette's Hurley/Logan approach with some of B. J. Palmer's methods and perspectives.^{23,27}

Roy Ashton graduated from the Standard School of Chiropractic in New York City, where he was dean for many years.¹⁰ Ashton's 1947 book, *Fundamental Chiropractic*, is based on clinical research of his myobasal technique from 1923 to 1940.¹⁰ His theories shared many similarities with concepts from Hurley and Logan. Ashton preferred what he called Carver's nerve occlusion hypothesis over D. D. Palmer's nerve impingement and nerve pressure model.¹⁰ Ashton felt that impingement referred to a diffuse phenomenon, whereas partial nerve occlusion indicated a more direct nerve pressure. He did take the D. D. Palmer position, however, that such pressure leads to irritation.¹⁰

Ashton proposed that when a spinal distortion developed, innate intelligence attempted to compensate by keeping the sacral base level and the center of gravity in line. He referred to this as a protective reaction. He felt that gravity eventually caused the muscle tone to increase and tire, leading to long-term pelvic distortion with a posteriorly rotated innominate. Secondary curves were thought to develop through compensation, which led to subluxations that were not automatically corrected by the body because of habitual hypertension of the spinal muscles. He referred to this as a "habit groove" of the nervous system. Ashton's method of analysis to determine the fundamental distortion included standing full-spine x-ray, inspection, palpation, measurement, and bilateral scales.¹⁰

Ashton felt that the nerve energy that was reflected from nerve occlusion was mostly stored in the periphery and that the proper technique assisted the body in using this energy for maximal correction. His application included a myotonic technique with light concussive vibrations in the form of contacts on the occiput and cervical vertebrae (especially the third), to reduce the hyper-tense muscles. This was followed by sustained contact on the ischial-pubic margin.¹⁰

Janse, Houser, and Wells published a 1947 updated edition of a textbook published in 1938 by Biron, Wells, and Houser,⁵⁸ which had been published in 1923 as the third edition of Forster's *Chiropractic Principles and Technic*.⁴⁷ In their 1947 edition, they included sections on neurology, reflex techniques, pressure technics, and spondylotherapy, as well as a section on extremity adjusting, which replaced an older section on the Meric system.^{14,47} The new chapter on reflex and pressure techniques was adapted from Janse's earlier writings on the topic.⁵⁹ Janse et al acknowledged the methods from Hurley to Logan and from DeJarnette to Ashton, without naming any specific technic. They classified several principles of reflex technics.¹⁴

Janse, Houser, and Wells viewed the periphery of the body as "a switchboard" filled with reflex circuits, which influence different body parts. The viscera could be influenced by specific somatic contacts. The peripheral tissues contained special sense organs that discriminated between "inimical" and "beneficial" stimuli. Citing Sherrington, they suggested that clinicians carefully use reflex contacts to cause relaxation rather than distress. They described a method of contacting the painful area with one hand while touching a "highly sensitive area" with the other, thereby distracting the brain's attention from the sensation. This could inhibit the original pathway and allow for restoration of normal physiology.¹⁴

It was thought that direct nerve blockage could inhibit the transmission of nerve stimulus and that there were many sensitive reflex areas, such as the gluteal, anal, and groin regions, which could initiate relaxation and vasodilation. Any form of contact in these regions that was "properly taken and carefully executed" would lead to release of tension, distress, and malalignment, as well as feelings of warmth, well-being, and even mild stimulation.¹⁴ Pressure technics worked in conjunction with muscle physiology. Light persistent contacts to the muscle belly or light firm stretching of the muscle could lead to the relaxation of contracted muscles. They described several techniques,

such as apex contact, sacrotuberous contact, 3-point gluteal contact, paraspinous contact, and gallbladder and liver reflex contacts (Fig 5).^{14,59}

Integrating Models

Several school leaders, researchers, and technique developers integrated many of the models of the time. The earliest of these leaders were Firth and Gillet. Both integrated the current knowledge about CVS and then developed their own models. Firth's disc model was based on the methods he developed at the PSC, combined with Basic Technique, and other methods.⁶ His students like R. J. Watkins, R. O. Muller, and Clarence Gonstead became leaders in the profession. Gillet and his colleagues studied most of the known approaches to CVS for many years and developed motion palpation, which developed into its own paradigm in chiropractic by the 1980s.^{5,11}

Firth's main contributions to the CVS literature up until he became president of Lincoln Chiropractic College (LCC) in 1940 included his book *Chiropractic Diagnosis*, which went into several editions through 1948. He also was a contributor to the Palmer technique manual, or *Vol. 13*.^{60,61} He was director of the "pit class" or the chiropractic open clinic at PSC and published regular case presentations from 1918 to 1922 with B. J. Palmer.⁶² It is possible Firth left the PSC because of a disagreement with Palmer over the implementation of thermography.⁶³ Firth started LCC with Burich, Vedder, and Hendericks, all former PSC faculty.²³

Firth's 1941 technique manual offers a glimpse into the development of his CVS model after 30 years as a chiropractor, teacher, and diagnostician.⁶ Firth's technique manual is a continuation of B. J. Palmer's earlier models and theories along with newer approaches. However, it did not emphasize Palmer's upper cervical work from the 1930s.⁶ The 1941 technique manual retained B. J.'s earlier approaches to adjusting including interior coccyx adjust-

Janse's Principles of Reflex Technics (quoted directly)	
1. The whole of the periphery is a "switchboard" of innumerable reflex circuits which extend to and influence all parts of the body.	
2. Special sensory end-organs are present in the peripheral tissues which possess discriminate capacities designating one stimulation as "inimical" and another as "beneficial."	
3. Distressing and painful interpretations may be avoided through the application of the principles of counteraction, distraction and suggestion.	
4. Inhibition of stimulus transmission is possible by direct nerve blockage.	
5. Certain areas of special sensitiveness exist from which innumerable reflexes of muscular relaxation and vasodilation may be initiated.	
6. Certain principles of muscle physiology permit the beneficial application of pressure technic.	

Fig 5. Janse's original principles of reflex technics.

ments for cord tension. The manual also included Logan Basic and other reflex technics.⁶ The manual may be the first integration of so many theories to that point.

Firth considered that chiropractic was based on a “subluxated” vertebra,⁶ which altered the size and shape of the intervertebral foramina, thus interfering with transmission of nerve force. He described a CVS as “a minute dislocation...a disrelationship existing between two adjacent articulating bones in which their articular surfaces remain in contact.”⁶ He included B. J. Palmer’s definition, which emphasized impingement on nerves and interference with mental impulse transmission. Firth considered the shape of the disc to play a vital role in CVS. According to his theory, a vertebra could only move in the plane of its articulating surfaces. Firth taught that disease was associated with both the concave and convex sides of a curvature. He felt that diseases could be eradicated by adjustments, which normalized the curvature. The role of the adjustment was to expand the disc, stretch the ligaments, and stretch contracted muscles, which resulted in correction and stimulation.⁶

Henri Gillet graduated from the PSC in 1928 (Fig 6). His father and brother were chiropractors. Gillet wanted to pursue a career as an engineer but agreed to follow his father’s wishes and become a Palmer graduate. His brother convinced him to research chiropractic. They decided to pursue every avenue of research from other schools of chiropractic and



Fig 6. Henri Gillet. (Courtesy of Special Services, Palmer College of Chiropractic.)

osteopathic research. After a year in the United States, Gillet completed a postgraduate course at LCC and then went back to Belgium.^{5,11}

Henri and his brother Marcel were eventually joined by Liekens, and the 3 pursued a scientific approach to defining and detecting CVS. Their starting point was to assume that CVS may not exist and that all current methods of CVS detection were worthy of exploration. They applied each new method for at least 6 months, checking and double-checking one another’s work.^{5,11}

Over the course of the first 2 decades of research, they employed methods available to them, such as thermography, palpation, x-ray analysis, and magnification of sweat glands. They adopted the phase 2 NCM developed by B. J. Palmer in the early 1930s. Gillet eventually developed his own thermography device, with a single probe for a unilateral spinal measurement.^{5,11}

Gillet and his colleagues would check, palpate, adjust, and recheck and then compare their notes for years.⁵ After studying with Illi in Switzerland, they bought an x-ray unit and developed meticulous line-drawing methodologies. They explored B. J. Palmer’s hole-in-one method for many months. They studied curves, pain points, tender spots, and heat spots. They also studied trophic reactions, vasomotor changes to pinpricks, and hyper- and hyposensitivity related to CVS. They poured over osteopathic, neurology, physiology, and anatomy texts. Their research continued for 50 years⁵ and explored several ways that CVS might affect nerves apart from the “nerve-pressure-at-intervertebral-foramina theory.”⁵ They theorized that the CVS could affect the cord and the sympathetic nerves and cause various types of irritation.⁵

After they realized that they were neglecting the measurement of muscles, ligaments, movement, and stiffness, Gillet and colleagues developed motion palpation.⁵ The most common finding was that a CVS was fixed in a position. They proposed that the vertebra did not “rest erect” with the rest of the spine. They suggested that many neurological phenomena may be related to such a fixation and found it best to examine the patient before asking for a case history.⁵

The Gillets, along with Liekens, proposed that chronic and degenerated CVS also had degenerated nerve endings. Such chronic cases required a combination of short thrusting recoil adjustments and longer slow kneading motions for 3 to 4 minutes. They also thought that different cases responded differently to either recoil adjustments or “relaxation adjustments.” They described that after they learned to determine the first, oldest, most chronic, or major CVS using the motion palpation methodology, then they started to see results, and other secondary CVSs would self-correct.⁵

Speranskian Theory. Speranskian CVS theories developed in part from the pressures to increase scientific standards,⁶⁴ which led to important collaborations and updated models from leaders in the field, such as Weiant,⁶⁵ Verner,⁶⁶ Muller,⁶⁷

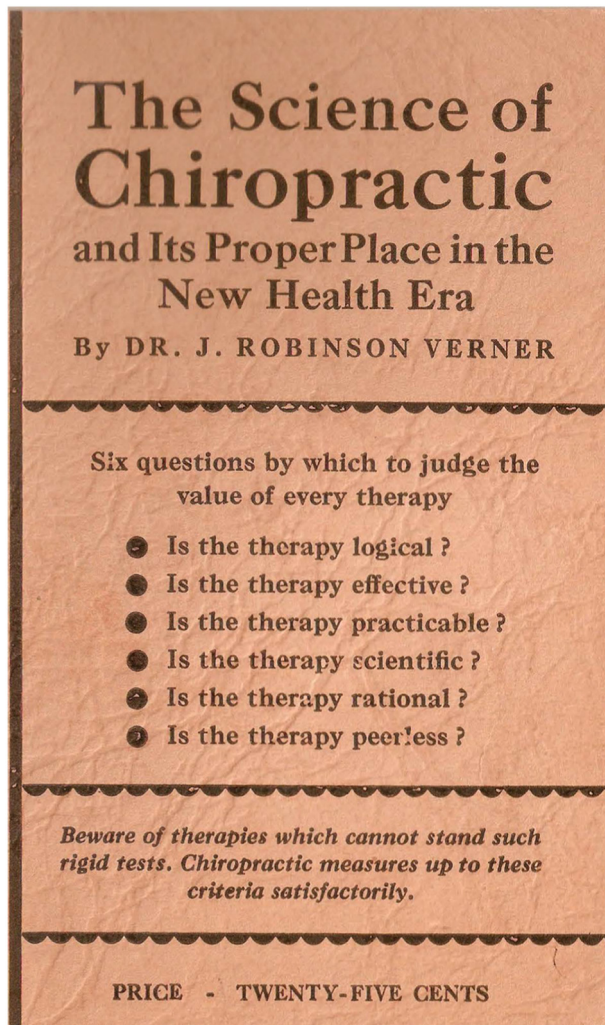


Fig 7. Cover of Verner's 1939 pamphlet.

R. J. Watkins,²⁰ and Heintze.²¹ In 1938, O. Hamilton Wright wrote, "In 1936, another medical scientist of world renown further substantiated the Chiropractic principle in his book, 'A basis for the theory of medicine.' I speak of Dr. A.D. Speransky, of Russia."⁶⁸ Integration of A. D. Speransky's theories became commonplace for many new CVS theories.⁶⁹

Speransky was director of the Institute of Patho-physiology and Experimental Therapy in Moscow and a member of the Academy of Sciences of the USSR.⁷⁰ Speransky was nominated for the Nobel Prize 8 times between 1934 and 1936 for his work on "trophic functions of the nervous system and its role in disease" and "the role of the nervous system in pathology."⁷¹ One of the nominations in 1934 came from Pavlov.⁷⁰ Speransky's research was based on decades of empirical studies of the nervous system with live animal subjects and access to perhaps hundreds of university-employed lab technicians.⁶⁹

Chiropractors from this era determined that Speransky's conclusions were basically the same as the theoretical foundations for chiropractic.^{19,20,28,65,72-74} The first published

writing linking Speransky's theories to chiropractic CVS theory may have been an article in *The Chiropractor*.⁷² Yet, the first chiropractor known not only to actively pursue Speransky's ideas but also travel to Russia and attend a conference he was speaking at was Arthur Heintze.⁷⁵ Heintze influenced Verner and Watkins.²⁰ B. J. Palmer's first reference to Speransky was in 1938,⁹ Verner's first mention was in 1939 (Fig 7),⁶⁶ and Watkins' was in 1946.²⁰ All felt that Speransky's research demonstrated the same explanations of the role of the nervous system in pathophysiology as the chiropractic paradigm.

Speranskian CVS theory is a class of theories that view the CVS as part of a global neurological and noxious phenomenon.²⁸ The chiropractic adjustment is viewed as a disruption to the pathophysiological pattern or process the nervous system is stuck in. According to this approach, the chiropractic adjustment disrupts the pattern of interference, irritation and impingement dissipate, and normal functions may then be expressed more fully as health.

J. R. Verner graduated from Collins' New Jersey College of Chiropractic in 1918. He completed postgraduate studies at PSC in 1920 and Carver Chiropractic College in 1922.⁷⁶ Verner taught at the New York School of Chiropractic from 1934 to 1944 and the Chiropractic Institute of New York until his death in 1961. Rehm called Verner "one of the foremost theorists and teachers" in the chiropractic profession, and Weiant referred to Verner's contribution as "a most valuable intellectual legacy."⁷⁶ His classic 1941 text, *The Science and Logic of Chiropractic*, went into 8 editions through 1956.¹⁹ In 1977, Weiant still considered it the most "important contribution to the literature of chiropractic ever written."⁷⁶

In the book, Verner described the neurological foundations of CVS.¹⁹ His references included Speransky as one of the latest neurological models in the literature. In describing Speransky's importance to the profession, he wrote:

With Speransky, the chiropractor holds that an intact nervous system is a sine qua non to health, and infection is no exception. The basic principle of chiropractic is that structural faults may interfere with normal nerve function. This in turn may permit the development of conditions favorable to the growth of bacteria and the production of their toxins. Chiropractic restores normal innervation in order to re-establish conditions which are unfavorable to pathogenic micro-organisms.¹⁹

Verner thought of CVS as a fixation at the extreme of normal movement and as a somatic or visceral disrelation. When CVS caused microscopic or macroscopic impingements, it was theorized that it could possibly interfere with the nervous system reflexes, affect remote areas of the body, and even cause delayed responses. He felt that CVS irritated synovial or periosteal structures. He proposed they could be perpetuated by an irritated afferent nerve, which may then stimulate its own motor nerve, causing the muscles to remain

contracted.¹⁹ This was a departure from B. J. Palmer's efferent emphasis.⁷⁷ If the afferent impulses caused by the CVS traveled back into the cord, a somatic reflex affected viscera.¹⁹ The CVS and poor posture were viewed as causes of nerve interference,¹⁹ which affected emotional and mental states and had psychological effects. The thought was that the impact of CVS on vasomotor and neurological integrity affected the structural basis of the mind. An intact nervous system was a prerequisite for mental health, according to Verner.^{19,66}

R. J. Watkins was a 1942 LCC graduate.²⁰ Upon returning from the army after WWII in 1946, he returned to LCC and took over the adjusting classes from Firth. Watkins' first writing period started in 1947 and 1948. In late 1947, he was recruited by his old teacher R. O. Muller to run the clinic at the new Canadian Memorial Chiropractic College (CMCC).⁶⁷ In 1948, Watkins published several articles and helped to author the CMCC technique manual with Homewood and other faculty members.^{8,20} In the manual, Watkins was the first to emphasize the key role of the small intersegmental muscles in CVS. Correspondence with Heintze led him to integrate the proprioceptive function of the intrinsic intersegmental muscles into his model.^{8,20}

Watkins' application of theory to practice was based on his study of D. D. Palmer and James Firth, that the subluxated joint was composed of 2 bones. Watkins developed the innovative double contact on 2 adjacent vertebrae to focus energy on the joint between them. He also did this on the sacroiliac joint. This approach was demonstrated in the CMCC technique manual.^{8,78}

Because of the increasing need to adopt more basic science literature, Watkins studied the latest texts from authors such as Speransky, Goldthwaite, Pottenger, Crile, and Kuntz.²⁰ His early writings reflected his studies. He referenced the chiropractic writings of D. D. Palmer, Firth, and Verner, and developed perhaps the most advanced neurological models of CVS the profession had yet seen.²⁰ Watkins started integrating Speransky's theories into models in 1948 with a review of Speransky's book published in the journal of the National Chiropractic Association and also with the publication of his article "A Treatise on Trophic Nerve Impulses." The article provided clinical examples of Speransky's concepts.⁷⁹

In 1949, Watkins published a paper titled "Tissue Memory in Retracting."⁸⁰ That paper also cited Speransky in relation to the retracing effect owing to heavy adjustments. Watkins wrote, "Heavy adjusting with a lot of shock element, whether recoil or some chemical shock will give a maximum of retracing. Speransky showed some of the violence of such retracing by the introduction of either chemical nervous shock or a heavy mechanical shock..."⁸⁰

He referred to specific and nonspecific recoil adjusting as well as Palmer's HIO model. He posited that light adjustments minimized the shock effect and lessened retracing effects. He suggested that reflex adjustments were best for chronic CVS because they minimized nerve shock and heavy adjustments were best for acute cases.⁸⁰

Watkins developed a neurological model to account for the reflex technics. He differentiated this from a simplified "bone out of place"²⁰ model, and explained how a light touch on the sacral tuberosus ligament, for example, could create a change in the whole spine and nervous system. Watkins wrote an article in 1948 titled "Anthropology in Reflex Technics,"¹⁶ and also developed muscular and neurological models to help explain Gillet's findings.

By 1949, Watkins laid out the foundation for proprioceptive postural reflex technics, inspired by his correspondence with Verner. These included his perianal technic and the auricular proprioceptive reflex technic.²⁰ He also developed a new model to understand and use suboccipital reflexes in CVS correction. He felt that all chiropractors should understand the neurophysiology of the reflex approaches apart from the mystery and commercialization in the profession. His model explored sustained contacts, occipital zones, and the change in muscle tone associated with the dissipation of the CVS.²⁰

Watkins published another paper in 1949 on the mechanism of a CVS.²⁰ He realized that chiropractic's growth was based on clinical practice, and he felt that people would understand explanations of how neurogenic symptoms arose from "faulty body mechanics."²⁰ The paper explored the literature supporting impingement at the foramina leading to sciatica, lumbago, abdominal referred pains, referred arm pain, intercostal neuralgias, pressure on sympathetic ganglia, neuritis, radiculitis, and several other duplications of pathophysiologic processes. Watkins wanted practitioners to understand the complexity of the CVS.²⁰

Chiropractic Vertebral Subluxation Perspectives (1928-1948)

Empirical, clinical, and scholarly research between 1928 and 1949 led to a completely new field of theory for the chiropractic profession. Theory of this era was different from 50 years prior. By tracing teacher-student relationships, collaborations, and reference patterns, one can see the development of ideas.

In addition to the 4 main types of theory presented above, this period also included at least 8 distinct perspectives. These perspectives have commonalities, novelty, and the historical attribute of affecting future theory (Fig 8).

Instrumentation Perspective. The instrumentation perspective started in 1910, with the introduction of chiropractic x-ray analysis. This perspective includes an attempt to understand the underlying mechanisms of CVS through the anatomical and physiological systems. With the advent of thermography and photoelectric technology in the 1920s to detect vascular changes,⁸¹ CVS detection instruments were thought to be able to detect the physiological phenomenon associated with CVS at a new level of objectivity.

Global anatomical methods were developed as objective measures to understand changes in posture and vertebral position. Plumbline analysis was pioneered by Hurley and

DeJarnette.^{12,15} Full-spine and standing x-ray analyses, proposed by Sausser at Loban's Universal Chiropractic College and refined by Logan and Illi, were developed to measure the effects of gravity.^{7,43,82}

Physiological measures were developed to study acute changes and long-term patterns. The PSC's new instruments during this time included the model 2 NCM in 1930, the NCM and the neurotempometer in 1936, the Neurocalograph in 1939, and in the 1940s several other innovations including the electroencephaloneuromentimograph.^{63,83} In the early 1930s, DeJarnette developed the vasomotor control hypo-hyper testers and the Junior Chromoclast.⁵⁵ Weiant and Adelman developed the Analyte in 1928 to take photos of capillary changes they thought might be associated with CVS.⁸⁴ Gonstead developed the Nervo-Scope and Analograph in the 1940s.³

Not only did technique developers use their own technologies to further refine and develop their theories, but they also incorporated one another's findings and technologies. For example, after Gillet learned about the Analyte, he started monitoring different types of vasomotor changes.⁵ Gillet used B. J. Palmer's latest NCM and developed his own thermography instrument. Furthermore, Gillet reanalyzed B. J. Palmer's x-ray research from 1938 and worked with Illi in Europe.^{5,9,11} Other instruments of varying diagnostic and commercial relevance were developed during this time by chiropractors.⁸⁵

Upper Cervical Perspective. The upper cervical perspective views the atlas and axis as the most important segments of the spine. This viewpoint was developed by leaders and graduates at the PSC in the early 1930s.³² The development of upper cervical-specific models influenced the profession for decades.^{27,32} B. J. Palmer's 1934 text is cited by his followers and his detractors.⁸⁶⁻⁸⁹ However, the research and detail of his theories are not well described in the

literature. For example, Palmer's periodicity model of CVS was described in 1933 and had its roots in his earlier theories from 1909 about the acute mild CVS, but it is all but lost to history.¹ His new insights about frequency and periodicity were derived from thermographic analysis of physiological patterns associated with CVS over time. His cord tension model, which he introduced in 1911, evolved, and by the 1930s the model centered on the upper cervical area and its spinal cord and meningeal attachments.^{1,2,26} Textbooks, peer-reviewed literature, technique models, CVS theories, and upper-cervical research today reference this as the origin of the upper cervical perspective.^{27,32,90}

Biomechanical Perspective. The biomechanical perspective was developed from several sources, including B. J. Palmer's cord tension model,¹ Carver's full-spine structural approach,⁹¹ Steinbach's spinal balance approach,⁹² and Hurley's sacral base approach.¹² According to Weiant, the structural approach was pioneered by Carver and Spears and it "transformed chiropractic analysis into a problem in mechanics."⁹² Carver's view of the full spine, spinal curves, and the sacrum as a center of gravity was a big influence during this period.⁹¹ Weiant proposed that Spears developed the curvature approach to CVS correction and emphasized inspection over palpation.⁹² Bodily distortion, starting with the sacrum, was the center point for Logan, Hurley, and DeJarnette.^{12,13,15} B. J. Palmer critiqued Logan and Hurley's ideas in the 1930s because he concluded their emphasis on "dis-ease, a contracted muscle, a distorted pelvis," was not targeting the cause, but rather the effects.⁹³

Others focused on biomechanics from different perspectives. For example, Gillet emphasized the fixated vertebra, and R. J. Watkins emphasized the joint between 2 vertebrae and the importance of faulty body mechanics.^{11,20} Watkins developed bilateral contacts on 2 adjacent vertebrae to

Perspective	Statement
Instrumentation Perspective	Physiological changes associated with vertebral subluxation can be detected with various types of instrumentation.
Upper Cervical Perspective	The upper cervical spine is prone to primary subluxation patterns that can cause compensations throughout the spine, spinal cord, and body.
Biomechanical Perspective	Body mechanics, spinal curves and scoliotic patterns may play significant roles in subluxation patterns, often starting from the sacral base or innominate.
Chronic Subluxation Perspective	New models of chronic subluxation included stored energy in the connective tissues and compensatory patterns related to fixation, biomechanics, and neurophysiology.
Reflex Subluxation Perspective	The neurological changes associated with subluxation may be reflex systems linking distant areas of the spine and body and perpetuating subluxation patterns.
Proprioceptive Perspective	Vertebral subluxation is caused by and perpetuates altered joint proprioception and may lead to spillover and cascade as aberrant neurological irritation.
Non-therapeutic Perspective	The evolution of the non-therapeutic model of subluxation was highlighted by the objective measures physiological and structural measures.
Neurodystrophic Perspective	Subluxation can be an initiator, an indicator, or a perpetuator of neurodystrophic breakdown in various body systems.

Fig 8. Eight perspectives on subluxation that emerged during the 1928-1949 period.

concentrate the force of corrective thrust upon 1 articulation.⁸ Gillet felt that fixation, stiffness, incoordination, or abnormal motion was more important than misalignment.⁹⁴

Chronicity Perspective. The chronic CVS perspective was advanced during this period by thought leaders such as B. J. Palmer,¹ Logan,⁷ Ashton,¹⁰ Watkins,²⁰ and Gillet.¹¹ D. D. Palmer was the first to suggest that time was a factor in the chronicity of CVS and directly proportional to the duration needed for adjustments.³⁹ B. J. Palmer elaborated on this theory in a 1913 pamphlet called “Momentum,”⁹⁵ which was developed by Stephenson and Drain.^{33,96} The theorists from this period added to more detailed biomechanical and neurophysiological rationales supported by the preliminary use of instrumentation to characterize chronic CVS.

Reflex Perspective. The reflex CVS perspective originated with D. D. Palmer.³⁹ He was the first to write about reflexive responses to nerve impingement owing to CVS. D. D. Palmer considered this one of chiropractic’s earliest principles. Citing Landois,⁹⁷ he noted that light nerve stretching and tension act as an irritant, which alters function.⁹⁸ The irritability was a reflex response and when the stretch increased, “the irritability and reflex activity” diminished.⁹⁸ D. D. Palmer also wrote that the return to normal tone was a reflex action.⁹⁸

Loban, Carver, Riley, and Forster incorporated reflex systems into their models.^{46-48,91,99} Loban wrote, “Reflex muscular tension tending to increase subluxation and thus augment nerve impingement and its effects.”¹⁰⁰ Forster also wrote of spontaneous adjustments, which included corrections during sleep when possible.⁴⁷ In the updated edition of his book, which was published by Janse et al, they referred to such corrections as “reflex” adjustments.¹⁴ The techniques developed by Hurley,¹² Logan,⁷ DeJamette,¹⁵ Ashton,¹⁰ and Watkins were all methods to enact this reflex perspective.^{16,101}

Proprioceptive Perspective. Price, Verner, and Watkins developed CVS models that shared characteristics with Stephenson’s vertemere cycle.^{2,19,20,44} The vertemere cycle described the neurological impact of the CVS on its own joint, thus keeping it subluxated.⁴⁴ These models later evolved into proprioceptive models.

Heintze was one of the pioneers in the profession to write about the proprioceptive perspective.²¹ Since 1912, Heintze put forward the idea that the proprioceptive sense helped to explain “chiropractic phenomena.”²¹ Heintze corresponded with Watkins after reading his 1948 article “Anthropology in Reflex Technics.”^{16,20} Watkins corresponded with Firth, Weiant, Verner, and Gillet, among others.²⁰ Collaboration was a new component of CVS model development and a key element in spreading the proprioceptive perspective.

Nontherapeutic Perspective. The nontherapeutic perspective originates with D. D. Palmer.³⁹ In an advertisement published by B. J. Palmer in 1902,¹⁰² which was mostly derived from D. D. Palmer’s articles and was republished in *The Science of Chiropractic*, he proposed that chiropractic was nontherapeutic because it did not address “effects” but instead addressed “causes.”^{36,103} D. D. Palmer developed nerve tracing,³⁶ which

led to B. J. Palmer’s Meric system and nerve tracing studies.^{35,104} These were early approaches to locate the “cause” of CVS.

This perspective changed and evolved over the years. The first nonsymptomatic approaches to CVS detection may have been from Howard and Forster. Both were early leaders of the NSC, and both wrote of CVS that presents with little or no symptoms or with some discomfort. The rationale to adjust was not to fix the discomfort but to decrease the interference.^{105,106}

This period introduced a new type of nonsymptomatic assessment. B. J. Palmer and Gillet independently developed nonsymptom analyses.^{1,5,11,26} B. J. Palmer’s Research Clinic included a case history as well as a medical and laboratory workup of every case. Gillet also took case histories. Both concluded that objective measures were enough to locate the CVS.^{1,5,11,26} Palmer included thermography and x-ray analysis. Gillet included motion palpation, supported by other objective findings. This form of nontherapeutic perspective no longer relied on symptoms to locate CVS.

Neurodystrophic Perspective. The neurodystrophic perspective started in the mid-1930s in chiropractic, with Heintze’s visit to Moscow to attend a talk by Speransky.⁷⁵ Speranskian approaches to CVS, such as Verner’s view that the adjustment disassociates the neuropathic syndrome and B. J. Palmer’s view that Speransky explains the disruption to “quantity energy flow” on the afferent and efferent sides of the cycle, offer entirely new perspectives.^{9,19} The integration of Speransky’s concepts introduced a new level of complexity, sophistication, and congruent (yet indirect) empirical bases to CVS theories. In Speransky’s theory, chiropractors found the same basic premise of the chiropractic paradigm: that pathological neurodystrophic processes could be disrupted by altering the central nervous system with some type of input.²⁰

The integration of Speransky’s neurodystrophic hypothesis could be viewed in the context of a wider integration of the physiological literature of the mid-20th century in relation to model building. Several theorists used the new information to increase science standards to integrate other researcher’s findings, such as Pottenger, Crile, Goldthwait, and Kuntz.^{1,19,20} Other models were used as further evidence to bolster the neurodystrophic perspective. Model building was considered by Keating and Mootz as “essential in the long-term evolution of chiropractic research,”¹⁰⁷ and an interesting counterpart to testing the theories. Model building and research continued after this period, guided by the neurodystrophic perspective and inclusive of other Russian neurophysiology literature.¹⁰⁸⁻¹¹⁰

Research and Evidence-based Medicine

This period was the start of research into CVS.

Validity Claims and Research. Martin’s analysis of chiropractors’ use of science during this period is relevant to understanding theory development and the new perspectives

that emerged during this time.²² Martin's approach may help to counter modern criticisms that there was no early research on CVS.^{22,111-113} He stated:

Chiropractors did not rely solely on assertions that technique and science could be equated to support their claims of scientific legitimacy. They also buttressed their claims to scientific status by performing clinical research. The format of chiropractic research publications, replete with tables and graphs, mirrored that of conventional scientific articles. Like orthodox publications, chiropractic studies often employed instruments of both conventional and chiropractic design and increasingly used scientific jargon. Critics doubted the integrity and accuracy of chiropractic statistics, but they could not simply dismiss chiropractic researchers as methodologically naive. During this era, conventional clinical science frequently featured nonexperimental designs. Prior to World War II the methodology adopted by chiropractic researchers differed less from that of orthodox clinical research than physicians would have liked to admit.²²

Martin concluded that chiropractors adopted an alternative approach to science that included conventional science but remained distinct from it.²² This perspective lends itself to different types of validity claims.¹¹⁴

The importance of validity was articulated in the early 1990s and included a focus on clinical trials and evidence-based medicine (EBM) as a pathway to validity claims.^{115,116} The critiques of EBM in alternative medicine,¹¹⁷⁻¹¹⁹ osteopathy,¹²⁰ cardiology,¹²¹ and chiropractic suggest that research should include methods in addition to clinical trials leading to a broader range of validity claims.^{114,122-125} In 1995, Sportelli wrote:

A danger of requiring unrealistic proof by scientific validation is one of practicality. With research limitations on sample size, compliance, demographics, etc., many more procedures which have the potential to be effective will be classed as "unnecessary," versus procedures of no value to be termed "effective." In the rush to reduce costs, and mandate compliance by providers, decision makers have a tendency to forget that "absence of proof is not proof of absence." In their quest to deny validity to many procedures simply because they do not meet the "gold standard" of proof, many valuable procedures are subject to denial and criticism. Even the gold standard becomes obsolete in time, however in the interim between VALID SCIENCE and CLINICAL EMPIRICISM, many people will be denied valuable health care. The question ultimately is, "Who will decide this issue?"¹²⁶

In the decades before EBM and clinical trials, chiropractors sought to bolster their scientific base and

demonstrate that chiropractic hypotheses could be pursued by systematic empirical and clinical observations.

Limitations and Importance of Research (1928-1949). Limitations of the research from this period include that the chiropractic profession had no infrastructure for research or government-sponsored grants like medical schools. Research was an attempt to "prove" chiropractic instead of the dispassionate pursuit of scientific facts. There were economic motivations to increase chiropractic school enrollments, spread technique models, and publicize chiropractic to the general public.¹²⁷ Martin refers to a chart from B. J. Palmer's research clinic from 1949 comparing the pre- and post-pH values of urinalysis from 2,006 patients who received upper cervical adjustments.^{22,128} In this research pamphlet, a list of objectives for the formation of the B. J. Palmer Chiropractic Clinic includes "Medical doctors said there is no vertebral subluxation. We decided to prove there is."¹²⁸ Keating, Green, and Johnson¹²⁷ point out that many chiropractors in the first half of the 20th century had a similar approach and perspective toward science and research.

Even with the limitations of the research designs and the social and cultural forces shaping the profession's agenda, research from this period should not be dismissed for several reasons. The leading reason is that the foundation of modern clinical practice was built from the chiropractic techniques,²⁷ models of CVS,¹²⁹ and systems of CVS analysis.¹³⁰ Several decades of models, research, instruction, and clinical practice were developed from this foundation.²³ Another reason is that leaders from the major chiropractic schools were engaged in these research projects during this time and after.^{1,2,5-21,82,84,92,131,132} Thus, dismissivism does not necessarily apply here.¹³³ Researchers from this period pioneered investigation into the possible effects of CVS correction on biomechanical and neurophysiological relationships with health outcomes (Fig 9).

After a 3-year Delphi process to develop a consensus on CVS terminology throughout the profession in the 1990s,¹³⁴ Chance and Peters officially adopted new definitions. In their editorial in the *Chiropractic Journal of Australia*, they note that many of the hypotheses remain untested but are not untestable.¹³⁵ From the perspective of this first era of research in chiropractic, I add to their statement: although the research from this period had limitations and did not use modern research methods or designs, it does not mean all of the research conducted during this time was worthless.

Claims of No Research. In recent years, several groups have claimed that there is no clinical research evidence on CVS.^{112,113,136-142} Several quotes may help demonstrate the disparity between such claims and the 2 decades of research from this early period. In June 2010, the General Council on Chiropractic of the UK issued a guideline that states, "The chiropractic vertebral subluxation complex is an historical concept but it remains a theoretical model. It is not supported by any clinical research evidence that would allow claims to be made that it is the cause of disease or health concerns."¹⁴³

Kent argues that the General Council on Chiropractic guidelines misrepresent positions and then use a straw man position to attack the opponent.¹⁴⁴ Some of Kent's examples are the claims that CVS theories rely on an antiquated monocausal viewpoint, that all CVS theories rely on the compression model of intervertebral foramina encroachment, and by suggesting the "subluxation-centered chiropractors do not or cannot practice in an evidence based model."¹⁴⁴ Modern CVS theory and practice refute these claims.

Ebrall refers to a similar claim in the context of relegating CVS to history in a policy statement adopted by several European, South African, and Australian schools.¹⁴⁵ He refers to the claim that CVS is viewed as "the cause of disease" but that no current literature makes this claim.¹⁴⁶

In another example, the president of the Norwegian Chiropractors' Association and president of the European Chiropractors' Union wrote, "The subluxation, however, has never been scientifically defined, tested or validated. At present there is no valid or reliable test to determine the presence or absence of a subluxation. And there is no valid test how to find a subluxation."¹⁴⁷

Good suggests that Mirtz et al misused Hill's criteria in relation to CVS research.^{136,148} In a response to Good's critique, Mirtz writes of the "subluxation construct" (SC):

Simply put, if there is little or no data providing evidence of the SC combined with and the claim chiropractors make to treat this putative entity as a causal agent then its validity should be considered unproven. Until data comes forth that can adequately demonstrate the existence of the SC and provide the necessary data that demonstrates that it is a causative agent in disease or ill health then the SC should be regarded as having no such valid utility.¹⁴⁹

Apart from the use of straw man arguments, the main questions these statements bring up have to do with what should account for evidence and validity in chiropractic research, especially because EBM has become more prominent in the last few years in the chiropractic field and is used by some to dismiss CVS research as nonexistent.^{111,112,136-142} This argument has also been used in an attempt to dictate the future of the chiropractic profession's identity.^{125,144}

Evidence-based Medicine and Chiropractic. In 2008, the National Center for Complementary and Alternative Medicine at the National Institutes of Health issued a second round of the R25 grant for education research at institutions of complementary and alternative medicine. The grant included several chiropractic colleges.^{150,151} Some of the goals were to change the culture at these institutions so that students would learn how to navigate evidence, write reviews of research literature, and develop critical thinking skills for clinical application.^{151,152} An emphasis of the grant was to train faculty in evidence-based practice and research literacy. The Process of Integrating

Evidence was developed as part of The Consortium of Evidence-Informed Practice Educators, which was established to coordinate intercollegiate cooperation across most chiropractic colleges.¹⁵³

Some literature critiques EBM in chiropractic,^{114,122-124,144,145} and other literature critiques EBM in general for clinical practice and alternative medicine.^{120,121,154} Hampton, an early proponent of EBM in cardiology,¹⁵⁵ suggests that EBM should be referred to as opinion-based medicine because it is read by some professionals in the form of meta-analysis of many studies, which are filtered through interpretations.¹²¹ Indick suggests that a dialogic approach should counter-balance EBM in patient care because it includes intuitive processes and nonempirical, functionalist, and developmental findings. This would de-emphasize the strict hold that logical positivism could have on a profession like chiropractic, which has its roots in a nonpositivistic and postrational worldview.^{124,154,156}

Ebrall critiques the overemphasis on evidence-based practice in chiropractic, especially chiropractic learning institutions, as an indictment of "chiropractic's social conscience." He wrote:

"If medicine in general expresses reservations regarding an unquestioning uptake of EBP perhaps it is somewhat unwise for academic chiropractors to wantonly embrace what seems to be a flawed paradigm and in so doing alter the premise under which chiropractic's social conscience is expressed in community care."¹⁴⁶

By chiropractic's premise, Ebrall refers to a contemporary concept of CVS and its correction.¹⁴⁶

Villanueva-Russell includes Hampton and Indick in her analysis of the early phase of EBM integration in chiropractic in the 1990s, during the movement to establish clinical practice guidelines.¹²⁴ She observed from one sociological perspective how EBM was used in chiropractic with an emphasis on the rise of professions and boundary control between and within professions. She concluded that EBM was used in chiropractic to control privileged positions associated with orthodox medicine even though the methodologies, epistemologies, and ontologies of chiropractic's original paradigm were "antipodal to the randomized, controlled, double-blind experiments of orthodox medicine."¹²⁴ She framed EBM as a professional mobility project by a segment of the chiropractic profession who were seeking to be more accepted by orthodox medicine. She suggested that EBM was being used as a form of social control to "de-legitimate the validity of chiropractic claims."¹²⁴ She noted concerns during guideline development; some felt that the profession was putting on "our own shackles,"^{124,157} by embracing the EBM paradigm.

The concern was that it was not only pressures within chiropractic and from orthodox medicine that had the greatest impact on EBM guidelines for clinical practice, but outside corporations and managed care entities that would

School Influence	Subluxation Theorist
Palmer School of Chiropractic	B.J. Palmer, Price, Gonstead, Gillet, Drain, Himes, Peterson
Lincoln Chiropractic College	Firth, Watkins, Gonstead, Muller, Gillet
Universal Chiropractic College	Loban, Logan, Illi
Canadian Memorial Chiropractic College	Muller, Watkins, Homewood, Himes, Peterson
Standard Chiropractic College	Ashton
New York Chiropractic College/ Chiropractic Institute of New York	Weiant, Verner, Kimmel
Nebraska Chiropractic College	DeJarnette
National Chiropractic College	Janse, Illi
Texas Chiropractic College	Drain, Weiant, Harper
Ratledge Chiropractic College College/ Los Angeles Chiropractic College	Ratledge, Higley
Western States Chiropractic College & University of Natural Healing Arts	Homewood

Fig 9. School leaders and faculty members engaged with subluxation theory, 1928-1949. CINY, Chiropractic Institute of New York; CMCC, Canadian Memorial Chiropractic College; LCC, Lincoln Chiropractic College; NYCC, New York Chiropractic College; PSC, Palmer School of Chiropractic; SCC, Standard Chiropractic College; UCC, Universal Chiropractic College.

require chiropractors to follow the guidelines, even if they went against clinical decisions based on the doctor–patient encounter.¹²⁴ This perspective was captured in Sportelli’s quote, “In their quest to deny validity to many procedures simply because they do not meet the ‘gold standard’ of proof, many valuable procedures are subject to denial and criticism.” When EBM dominates the discourse, positivistic science becomes the arbiter of legitimacy.¹²⁴

Several authors have pointed out the limitations of EBM as the sole model through which to make claims of validity. Hampton concluded that EBM is important but should not limit physician choice because all patients are unique and rarely reflect those recruited for clinical trials. A clinical trial may tell the effectiveness of treatments but not which patients should receive them.¹²¹ Draper and Richards suggest that the doctor–patient encounter has too many unforeseen variables and that awareness of the limitations of EBM be at the forefront of implementation in chiropractic.¹²³ Rosner suggests alternative research strategies to overcome the limitations of EBM for physical medicine in general, which applies to chiropractic.¹²²

The alternative view of science that Martin described is congruent with Villanueva-Russell’s opinions, that chiropractic research before the 1990s was an alternative to positivistic science.^{22,124} Based in part on these sociological assessments, I previously suggested that this alternative scientific perspective points to a postrational approach to science within the chiropractic paradigm.^{114,156} Such an approach applies the scientific method to a wider range of knowledge domains and does not limit research to only 1 gold standard; instead, it may include gold standards from many methodologies.

Integral approaches to research offer freedom from strict adherence to overly rational evidence-based approaches.¹⁵⁸ Postrational approaches to research might include the perspectives of empiricism, systems, cultural influence, interpersonal relationships, and phenomenological approaches, such as quality life expression and various levels of subjective wellbeing, including the sense of coherence developed from the salutogenic paradigm.^{159,160} Alternative research methods, however, do not absolve chiropractic research of the past from

its weaknesses or limitations, nor do they excuse scientific rigor.

Beyond simply understanding the recent literature on CVS,^{27,129,161-163} which was one of Good's recommendations to Mirtz et al,¹⁴⁸ it would be useful for chiropractors to understand the historical literature, especially the period from 1928 to 1949. This period was the start of profession-wide research on CVS, much of which became the foundation of modern practice. There are many practical applications of chiropractic that arose from this limited research, some of which may still remain as hypotheses to be explored. Learning the history of these theories in this context opens the possibilities for clinical research from many perspectives and a greater depth of understanding of the roots of clinical practice.

Limitations

This article reflects one person's interpretation of historical writings and theories. This paper attempted to provide detail on the evolution of CVS over a 21-year time span and is not without its limitations. The literature of this period is expansive, and some of the sources are fairly rare. It is possible that additional sources might change some of the interpretations offered in the present paper. Future reviews of the literature should include more systematic methods. Without detailed search parameters, inclusion and exclusion criteria, synthesis methods, a standard critical appraisal of the literature reviewed, and evaluation of bias, conclusions do need to be made with caution. A strength of this work is that it includes new insights into the history of the CVS based on primary and secondary sources, many of which have not been included in previous works. However, this research is limited by the writings that are currently available.

CONCLUSION

An examination of the development of CVS theories in chiropractic between 1928 and 1949 points to a robust field of research and modeling. Taking into account the various ways that validity claims might be made while undertaking empirical research, the chiropractic profession today may choose to explore the myriad approaches from this period and determine what research is yet left undone. Considering that 4 types of theory emerged during this period, along with 8 perspectives on CVS, the modern practitioner may choose to become better acquainted with the historical literature. This approach might encourage a greater understanding of the roots of modern practice, inspiration for future research, and a stronger ability to interpret and critique the literature.

ACKNOWLEDGMENTS

The author acknowledges Brian McAulay, DC, PhD, David Russell, DC, Stevan Walton, DC, and the Tom and

Mae Bahan Library at Sherman College of Chiropractic for their assistance.

FUNDING SOURCES AND CONFLICTS OF INTEREST

The author received funding from the Association for Reorganizational Healing Practice and the International Chiropractic Pediatric Association for writing this series of papers. No conflicts of interest were reported for this study.

CONTRIBUTORSHIP INFORMATION

Concept development (provided idea for the research): S.A.S.

Design (planned the methods to generate the results): S.A.S.
Supervision (provided oversight, responsible for organization and implementation, writing of the manuscript): S.A.S.
Data collection/processing (responsible for experiments, patient management, organization, or reporting data): S.A.S.
Analysis/interpretation (responsible for statistical analysis, evaluation, and presentation of the results): S.A.S.
Literature search (performed the literature search): S.A.S.
Writing (responsible for writing a substantive part of the manuscript): S.A.S.

Critical review (revised manuscript for intellectual content, this does not relate to spelling and grammar checking): S.A.S.

Practical Applications

- This series of articles provides an interpretation of the history and development of chiropractic vertebral subluxation theories.
- This series aims to assist modern chiropractors in interpreting the literature and developing new research plans.

REFERENCES

1. Palmer BJ. *Clinical Controlled Chiropractic Research: Vol. 25*. Davenport, IA: Palmer School of Chiropractic; 1951.
2. Price G. Occipito-atlanto-axial region. In: Stephenson R, ed. *Chiropractic Textbook: 1940 Edition*. 2nd ed. Davenport, IA: The Palmer School of Chiropractic; 1948.
3. Amman M. The machines and tools of Dr. Clarence S. Gonstead. *Chiropr Hist*. 2007;27(2):54-58.
4. Kyneur J, Bolton S. Lost technology: the rise and fall of chiropractic instrumentation. *Chiropr Hist*. 1992;12(1):31-35.
5. Gillet H. The history of motion palpation. *Eur J Chiropr*. 1983;31:196-201.

6. Firth J. *Chiropractic Technique Notes: As Compiled from the Lectures of Dr. James N. Firth*. Indianapolis, IN: Lincoln Chiropractic College; 1941.
7. Logan H. *Logan Basic Methods*. St. Louis, MO: Logan; 1950.
8. Watkins RJ, Greenshields C, Lee H, Wynn R, Homewood AE. *A Text-book of Chiropractic Technique*. Toronto, CA: Canadian Memorial Chiropractic College; 1948.
9. Palmer BJ. *Precise, Posture-constant, Spinograph, Comparative Graphs: Vol. 20*. Davenport, IA: Palmer School of Chiropractic; 1938.
10. Ashton RS. *Fundamental Chiropractic*. 2nd ed. New York, NY: Roy S. Ashton; 1948.
11. Gillet H. The evolution of a chiropractor. *Natl Chiropr J*. November 1945;15-19, 54-55.
12. Hurley J, Sanders H. *Aquarian Age Healing for You*. Los Angeles, CA: Haynes Corporation; 1932.
13. Logan H. *Logan Universal Health Basic Technique*. St. Louis, MO: Logan; 1931.
14. Janse J, Houser RH, Wells BF. *Chiropractic Principles and Technic: For Use by Students and Practitioners*. Chicago, IL: National College of Chiropractic; 1947.
15. DeJarnette B. *Sacro Occipital Technic*. Nebraska City, NE: DeJarnette; 1933.
16. Watkins RJ. Anthropology in reflex technics. *J Natl Chiropr Assoc*. August 1948. In: Walton S. *The Complete Chiropractor: RJ Watkins, DC, PhC, FICC, DACBR*. Asheville, NC: The Institute Chiropractic; 2017:761-766.
17. Palmer BJ. *The Known Man or an Explanation of the "Phenomenon of Life": Vol. 19*. Davenport, IA: Palmer School of Chiropractic; 1936.
18. De Jarnette B. *Vasomotor Control*. Nebraska City, NE: M.B. DeJarnette; 1931.
19. Verner J. *The science and Logic of Chiropractic*. 8th ed. Brooklyn, NY: Dr. P.J. Cerasoli; 1956.
20. Walton S. *The Complete Chiropractor: RJ Watkins, DC, PhC, FICC, DACBR*. Asheville, NC: The Institute Chiropractic; 2017.
21. Heintze A. The proprioceptive faculty: a broader theory of chiropractic is indicated. *Chiropr J*. February 1937;11,44.
22. Martin S. "The only true scientific method of healing": chiropractic and American science. *Isis*. 1994;85(2):207-227.
23. Keating J, Callender A, Cleveland C. *A History of Chiropractic Education in North America*. Association for the History of Chiropractic; 1998.
24. Baker J. Fred W.H. Illi, DC (1901-1981): a clinical reformation in chiropractic. *J Am Chiropr Assoc*. June 1997; 53-56.
25. Keating J, Clarence W. Weiant, D.C., PH.C., PH.D.: an early chiropractic scholar. *Chiropr Hist*. 2000;20(2):49-79.
26. Palmer BJ. *The Subluxation Specific the Adjustment Specific: Vol. 18*. Davenport, IA: Palmer School of Chiropractic; 1934.
27. Cooperstein R, Gleberzon B. *Technique Systems in Chiropractic*. Philadelphia, PA: Churchill Livingstone; 2004.
28. Senzon S. Chiropractic and systems science. *Chiropractic Dialogues*. 2015;25:9-20.
29. Palmer BJ. Is there an ebb and tide to subluxation. *Chiropractor*. 1933;29(4):6,29.
30. Palmer BJ. When is a vertebral subluxation. *Chiropractor*. 1933;29(5):6.
31. Elliott N. Hole-in-one theory absolutely right. *Fountainhead News*. 1930;18(3):1-2.
32. Eriksen K, Grostic R. History of the Grostic/orthospinology procedure. In: Eriksen K, Rochester R, Grostic J, eds. *Orthospinology Procedures: An Evidence-Based Approach to Spinal Care*. Philadelphia, PA: Lippincott Williams and Wilkins; 2007.
33. Stephenson R. *Chiropractic Textbook*. Davenport, IA: Palmer School of Chiropractic; 1927.
34. Palmer BJ. *The Science of Chiropractic: Eleven Physiological: Vol. 2*. Davenport, IA: Palmer School of Chiropractic; 1907.
35. Palmer BJ. *The Science of Chiropractic: Causes Localized: Vol. 4*. Davenport, IA: Palmer School of Chiropractic; 1908.
36. Palmer DD. *The Science, Art, and Philosophy of Chiropractic*. Portland, OR: Portland Printing House; 1910.
37. Palmer BJ. *The Philosophy and Principles of Chiropractic Adjustments: A Series of Thirty Eight Lectures; Vol. 3*. Davenport, IA: Palmer School of Chiropractic; 1911.
38. Palmer BJ. *The Philosophy and Principles of Chiropractic Adjustments: A Series of Twenty-Four Lectures; Vol. 3*. Davenport, IA: Palmer School of Chiropractic; 1908.
39. Palmer DD, Palmer BJ. *The Science of Chiropractic*. Davenport, IA: The Palmer School of Chiropractic; 1906.
40. Palmer DD. *The Chiropractor*. Los Angeles, CA: Press of Beacon Light Printing Company; 1914.
41. Keating J. The evolution of Palmer's metaphors and hypotheses. *Philos Constructs Chiropr Prof*. 1992;2(1):9-19.
42. In memoriam: Galen R Price 1912-2000. *Chiropr J Aust*. 2000;30(1):29.
43. Rehm W. *Necrology*. Who's Who in Chiropractic; 1980. In: *Who's Who in Chiropractic, International*. Dzaman F, ed. Littleton, CO: Who's Who in Chiropractic, International Publishing Co.
44. Stephenson R. *Chiropractic Textbook: Vol. 14*. 2nd ed. Davenport, IA: Palmer School of Chiropractic; 1940.
45. Palmer BJ. *Answers: Vol. 28*. Davenport, IA: Palmer College; 1952.
46. Loban J. *Technic and Practice of Chiropractic*. Loban Publishing Co; 1915.
47. Forster A. *Principles and Practice of Chiropractic*. 3rd ed. Chicago, IL: The National Publishing Association; 1923.
48. Riley S. *Conquering Units: Or the Mastery of Disease*. J.S. Riley; 1921.
49. Homewood AE. *The neurodynamics of the vertebral subluxation*. Homewood; 1962/1981.
50. Haldeman S. Spinal and paraspinal receptors. *ACA J Chiropr*. 1972;VI:S-25.
51. Stonebrink R. Neurological features of the chiropractic philosophy. *J Am Chiropr Assn*. 1968;2:33-40.
52. Sato A. The somatosympathetic reflexes: their physiological clinical significance. In: Goldstein M, ed. *The Research Status of Spinal Manipulative Therapy: A Workshop Held at the National Institutes of Health, February 2-4, 1975*. Bethesda, MD: U.S. Department of Health, Education, and Welfare; 1975:163-172.
53. History: Dr. Hurley. Available at: http://www.hurleyosborn.com/history_hurley.html. Accessed October 7, 2016.
54. Montgomery P. Personal communication. *October 4*. 2016.
55. Keating J. Chronology of Major B. DeJarnette, D.O., D.C. *Natl Institute Chiropr Res*. 2004.
56. DeJarnette B. *Spinal Distortions*. Nebraska City, NE: Priv. Pub. by Major B. DeJarnette; 1935.
57. Gregory AS. *Spondylotherapy Simplified*. Oklahoma City, OK: Self-published; 1914.
58. Biron WA, Wells BF, Houser RH. *Chiropractic Principles and Technic: For Use by Students and Practitioners*. Chicago, IL: National College of Chiropractic; 1939.
59. Janse J. Study of reflex and pressure technics. *Natl Chiro J*. 1946;XVI(Dec):9-10.
60. Firth J. *Chiropractic Symptomatology: Vol. 7*. Davenport, IA: Palmer College of Chiropractic; 1925.
61. Palmer BJ. *A Textbook on the Palmer Technique of Chiropractic: Vol. 13*. Davenport, IA: Palmer College; 1920.

62. *The PSC clinical journal. Chiropractor.* 1918;14(8):16-27.
63. Peters R. *An Early History of Chiropractic: The Palmers and Australia.* Asheville, NC: Integral Altitude; 2014.
64. Gevitz N. "A course sieve": basic science boards and medical licensure in the United States. *J History Med Allied Sci.* 1988; 43:36-63.
65. Weiant C. Lessons from Speransky: some specific applications of chiropractic. *Natl Chiropr J.* December 1942;11-12.
66. Verner J. *The Science of Chiropractic and Its Proper Place in the New Health Era.* Closter, NJ: Venard Press; 1939.
67. Muller RO. *Autonomics in Chiropractic: The Control of Autonomic Imbalance.* Toronto, Canada: The Chiro Publishing Company; 1954.
68. Wright H. Unfinished business. *Chiropractor.* 1938;34(1): 12-29.
69. Speransky A. In: Dutt C, ed. *A basis for the theory of medicine.* New York, NY: Inter-national Publishers; 1936.
70. *Editor Obituary: AD Speransky, MD. Br Med J.* August 21, 1961;v.2(5249):459.
71. Nobel. *Nomination Database: Alexei D Speransky;* 2016. Available at: https://www.nobelprize.org/nomination/redirector/?redir=archive/show_people.php&id=8692. Accessed September 15, 2016.
72. Wright H. Take your choice. *Chiropractor.* 1936;33(11):9-10, 23-24.
73. Lubka B. Prof. A.D. Speransky's research and chiropractic. *Chiropractor.* 1939;35(1):5.
74. Lubka B. The relation of normal nerve function to health: a prize-winning essay in the 1940 National Chiropractic Essay Contest. *Chiropractor.* 1940;36(9):7.
75. Chiropractors of three states meet in Spartanburg. *The Burlington (N.C.) Daily Times - News;* 1936. November 27.
76. Rehm W. "J.R. Verner, D.C." In: Dzaman F, ed. *Who's Who in Chiropractic, International.* Littleton, CO: Who's Who in Chiropractic, International Publishing Co; 1980:301.
77. Palmer BJ. *Philosophy of Chiropractic: Vol. 5.* Davenport, IA: Palmer School of Chiropractic; 1909.
78. Walton S. *Evolution of Reflex Techniques.* unpublished.
79. Watkins RJ. A treatise on trophic nerve impulses. *J Natl Chiropr Assoc.* December 1948. In: Walton S. *The Complete Chiropractor: RJ Watkins, DC, PhC, FICC, DACBR.* Asheville, NC: The Institute Chiropractic; 2017:219-221.
80. Watkins RJ. Tissue memory in retracing. *NCA Convention.* 1949. In: Walton S. *The Complete Chiropractor: RJ Watkins, DC, PhC, FICC, DACBR.* Asheville, NC: The Institute Chiropractic; 2017:223-226.
81. Kimmel E. Electro Analytical Instrumentation: Part 3 - Conclusion. *ACA J Chiropr.* June 1966;11-14, 49-52.
82. Illi F. *The Vertebral Column: Life-line of the Body.* Lombard, IL: National College of Chiropractic; 1951.
83. Palmer BJ. *History in the Making: Vol. 35.* Davenport, IA: Palmer School of Chiropractic; 1957.
84. Weiant C, Adelman G. Photography through the skin proves chiropractic a science. *J Natl Chiropr Assoc.* 1952 April.
85. Kyneur J, Bolton S. Chiropractic instrumentation—an update for the '90s. *Chiropr J Aust.* 1991;21(3):82-94.
86. Wardwell W. *Chiropractic: History and Evolution of a New Profession.* St. Louis, MO: Mosby; 1992.
87. Boone W, Dobson G. A proposed vertebral subluxation model reflecting traditional concepts and recent advances in health and science: part II. *J Vert Subl Res.* 1996;1:23-32.
88. Amman M. A profession seeking clinical competency: the role of the Gonstead chiropractic technique. *Chiropr Hist.* 2008;28(2):81-91.
89. Keating J. Philosophical barriers to technique research in chiropractic. *Chiropr Technique.* 1989;1(1):184-186.
90. Eriksen K. *Upper Cervical Subluxation Complex: A Review of the Chiropractic and Medical Literature.* Baltimore, MD: Lippincott Williams & Wilkins; 2004.
91. Carver W. *Carver's Chiropractic Analysis of Chiropractic Principles: As Applied to Pathology, Relatology, Symptomology and Diagnosis.* East Aurora, NY: Carver; 1922.
92. Weiant C. A review of the methods of spinal analysis. *Eur Chiropractor.* 1938 March(1):10.
93. Palmer BJ. Disciplining the hour. *Chiropractor.* 1933;30(2):6.
94. Gillet H, Gaucher-Peslherbe P. New light on the history of motion palpation. *J Man Phys Ther.* 1996;19(1):52-59.
95. Palmer BJ. Momentum. *Chiropractor.* 1913;9(4):45-49.
96. Drain J. *Chiropractic Thoughts.* San Antonio, TX: Standard Print Company; 1927.
97. Landois L. *Textbook of Human Physiology.* P. Blakiston, Son & Company; 1889.
98. Palmer DD. *The Chiropractor Adjuster.* 1909;1(7).
99. Riley S. *Science and Practice of Chiropractic With Allied Sciences.* Washington, DC: J.S. Riley; 1919.
100. Loban J. *Technic and Practice of Chiropractic.* Loban Publishing Company; 1916.
101. Watkins RJ. *Auricular proprioceptive postural reflex technic.* DCE; December 1992. In: Walton S. *The Complete Chiropractor: RJ Watkins, DC, PhC, FICC, DACBR.* Asheville, NC: The Institute Chiropractic; 2017:691-697.
102. Palmer BJ. *Chiropractic: its value to suffering humanity.* The Davenport Times; 1902.
103. Waters T. *Chasing D.D.: D.D. Palmer in the news 1886-1913.* Raleigh, NC: Lulu, Inc; 2013.
104. Palmer BJ. *The Philosophy, Science, and Art of Chiropractic Nerve Tracing: A Book of Four Sections: Vol. 6.* Davenport, IA: Palmer School of Chiropractic; 1911.
105. Howard J. *Encyclopedia of Chiropractic (The Howard System).* Chicago, IL: National School of Chiropractic; 1912.
106. Forster A. *Principles and practice of spinal adjustment.* Chicago, IL: The National School of Chiropractic; 1915.
107. Keating J, Mootz R. Five contributions to a philosophy of the science of chiropractic. *J Manipulative Physiol Ther.* 1987;10 (1):25-29.
108. Peterson A, Watkins RJ, Himes H, College CMC. *Segmental Neuropathy: The First Evidence of Developing Pathology.* Canadian Memorial Chiropractic College; 1965.
109. Harper W. Clarifying the term "irritation" and its relationship to the chiropractic premise. *J Natl Chiropr Assoc.* 1954;11:9-11.
110. Weiant C. *Medicine and Chiropractic.* New York, NY: Chiropractic Institute; 1958.
111. Reggars J. Chiropractic at the crossroads or are we just going around in circles? *Chiropr Man Ther.* 2011;19(1):1.
112. Carter R. Subluxation – the silent killer. *J Can Chiropr Assoc.* 2000;44(1):9.
113. Keating J, Hyde TE, Menke JM, Seaman D, Vincent R, Wyatt L. In the quest for cultural authority. *Dyn Chiro.* 2004;26(22):1-2.
114. Senzon S. Constructing a philosophy of chiropractic I: an Integral map of the territory. *J Chiropr Hum.* 2010;17(17):6-21.
115. Keating J. *Toward a Philosophy of the Science of Chiropractic: A Primer for Clinicians.* Stockton, CA: Stockton Foundation for Chiropractic Research; 1992.
116. Keating J, Charton K, Grod J, Perle S, Sikorski D, Winterstein J. Subluxation: dogma or science. *Chiropr Osteopat.* 2005;13(17).
117. Lambert H. Accounting for EBM: notions of evidence in medicine. *Soc Sci Med.* 2006;62(11):2633-2645.
118. Koutouvidis N. CAM and EBM: arguments for convergence. *J Royal Soc Med.* 2004;97(1):39-40.
119. Borgerson K. Evidence-based alternative medicine? *Perspect Biol Med.* 2005;48(4):502-515.

120. Parker JD. Reversing the paradox: evidence-based medicine and osteopathic medicine. *J Am Osteopath Assoc.* 2014;114(11):826-827.
121. Hampton J. Evidence-based medicine, opinion-based medicine, and real-world medicine. *Perspect Biol Med.* 2002;45(4):549-568.
122. Rosner A. Evidence-based medicine: revisiting the pyramid of priorities. *J Bodyw Mov Ther.* 2012;16(1):42-49.
123. Draper B, Richards D. Commentary: Clinical uncertainty. *Chiropr J Aust.* 2013;43(3):99.
124. Villanueva-Russell Y. Evidence-based medicine and its implications for the profession of chiropractic. *Soc Sci Med.* 2005;60:545-561.
125. Villanueva-Russell Y. Caught in the crosshairs: identity and cultural authority within chiropractic. *Soc Sci Med.* 2011;72(11):1826-1837.
126. Sportelli L. *Response by American Chiropractic Association: February 4, 1994 "20/20" segment.* American Chiropractic Association; 1994.
127. Keating J, Green B, Johnson C. "Research" and "science" in the first half of the chiropractic century. *J Man Phys Ther.* 1995;18(6):357-378.
128. Palmer BJ. *Urological Changes Under Specific Chiropractic Adjustments: Research on 2006 Cases at the B. J. Palmer Chiropractic Clinic.* Davenport, IA: Palmer School of Chiropractic; 1949.
129. Gatterman M. *Foundations of Chiropractic Subluxation.* 2nd ed. St. Louis, MO: Mosby; 2005.
130. Faye LJ. The subluxation complex. *J Chiropr Humanit.* 1999;9.
131. Janse J. In memoriam: Fred W. Illi passes away. *ACA J Chiropr.* January 1984:94-95.
132. Drain J. *Man Tomorrow.* San Antonio, TX: Standard Print Company; 1949.
133. McAulay B. Rigor in the philosophy of chiropractic: beyond the dismissivism/authoritarian polemic. *J Chiropr Humanit.* 2005;12:16-32.
134. Gatterman M. Development of chiropractic nomenclature through consensus. *J Man Phys Ther.* 1994;17(5):302-309.
135. Chance M, Peters R. Is subluxation our worst enemy? *Chiropr J Aust.* 2005;35(4):121.
136. Mirtz T, Morgan L, Wyatt L, Greene L. An epidemiological examination of the subluxation construct using Hill's criteria of causation. *Chiropr Osteopat.* 2009;17(1):1.
137. Bronfort G, Haas M, Evans R, Leininger B, Triano J. Effectiveness of manual therapies: the UK evidence report. *Chiropr Osteopat.* 2010;18(1):1.
138. Gliedt J, Hawk C, Anderson M, et al. Chiropractic identity, role and future: a survey of North American chiropractic students. *Chiropr Man Ther.* 2015;23(1):1.
139. Huijbregts P. The chiropractic subluxation: implications for manual medicine. *J Man Phys Ther.* 2005;13(3):139-141.
140. Nelson C, Lawrence D, Triano J, et al. Chiropractic as spine care: a model for the profession. *Chiropr Man Ther.* 2005;13(1):9.
141. Murphy D, Schneider M, Seaman D, Perle S, Nelson C. How can chiropractic become a respected mainstream profession? The example of podiatry. *Chiropr Osteopat.* 2008;16(10).
142. Schneider M, Murphy D, Perle S, Hyde T, Vincent R, Ierna G. 21st century paradigm for chiropractic. *J Am Chiropr Assoc.* 2005;8-15 Jan/Feb.
143. Council GC. *Guidance on Claims Made for the Chiropractic Vertebral Subluxation Complex.* London, England: General Chiropractic Council; 2010.
144. Kent C. An analysis of the General Chiropractic Council's policy on claims made for the vertebral subluxation complex. *J Philosophy Principles Pract Chiropractic.* May 16, 2011:1-9.
145. SOFEC. *Clinical and professional chiropractic education: a policy statement.* Societe Franco-Europeenne de Chiropaxic; 2015.
146. Ebrall P. Commentary: Is EBM damaging the social conscience of chiropractic? *Chiropr J Aust.* 2016;44(3):203-213.
147. McCoy M. ECU President Calls Subluxation Concept Outdated. *The Chronicle of Chiropractic.* October 3, 2012. Available at: <http://chiropractic.prosepoint.net/45683>. Accessed November 19, 2018.
148. Good C. A criticism of an epidemiological examination of the subluxation construct using Hill's criteria of causation: limitations, suspect conclusions and an opportunity missed. *Chiropr Osteopat.* 2010;17(13).
149. Mirtz T. Subluxation epidemiology: a response to Dr. Good. *Chiropr Osteopat.* 2010;17(13).
150. Evans R, Maier M, Delagran L, Kreitzer MJ, Sierpina V. Evidence informed practice as the catalyst for culture change in CAM. *Explore (NY).* 2012;8(1):68.
151. Long CR, Ackerman DL, Hammerschlag R, et al. Faculty development initiatives to advance research literacy and evidence-based practice at CAM academic institutions. *J Altern Complement Med.* 2014;20(7):563-570.
152. Kreitzer MJ, Sierpina VS. NCCAM awards grants to CAM institutions to enhance research education. *Explore (NY).* 2008;4(1):74-76.
153. CEIPE. *The consortium of evidence-informed practice educators: Mission;* 2016.
154. Indick W. Fight the power: the limits of empiricism and the costs of positivistic rigor. *J Psychol.* 2002;136(1):21-36.
155. Hampton JR. The end of clinical freedom. *Br Med J (Clin Res Ed).* 1983;287(6401):1237.
156. Senzon S. Constructing a philosophy of chiropractic: when worldviews evolve and postmodern core. *J Chiropr Humanit.* 2011;18(1):39-63.
157. Clum G. Fact myth. *ACA J Chiropr.* 1992;29(10):78.
158. Esbjörn-Hargens S. Integral research: a multi-method approach to investigating phenomena. *Constructivism Hum Sci.* 2006;2(1):79-107.
159. Esbjörn-Hargens S. An overview of integral theory: an all inclusive framework for the 21st century. *Integral Institute.* 2009:1-24 Resource Paper No. 1(March 2009).
160. Antonovsky A. The structure and properties of the sense of coherence scale. *Soc Sci Med.* 1993;36(6):725-733.
161. Haldeman S. *Principles and Practice of Chiropractic.* New York, NY: McGraw-Hill; 2004.
162. Leach R. *The chiropractic Theories: A Textbook of Scientific Research.* 4th ed. Lippincott Williams & Wilkins; 2004.
163. Bergmann T, Peterson D. *Chiropractic Technique: Principles and Procedures.* 3rd ed. St. Louis, MO: Elsevier; 2011.



The Chiropractic Vertebral Subluxation

Part 7: Technics and Models From 1962 to 1980

Simon A. Senzon, MA, DC

ABSTRACT

Objective: The purpose of this paper is to review and discuss the history of chiropractic vertebral subluxation (CVS) theories and models between 1962 and 1980.

Discussion: This period was marked by several innovative texts from Weiant, Homewood, and Harper, and Canadian Memorial Chiropractic College's *Segmental Neuropathy*. Technique developers during this period increased the complexity of models from upper cervical to full spine. The textbooks built upon previous theories, the scientific literature, work by Speransky, and instrumentation research. The texts influenced decades of research and theory. Weiant's book surveyed the medical and scientific literature on CVS. Harper integrated modern neurophysiology with D. D. Palmer's theories integrated with other chiropractic models based on research such as Weiant's photoelectric instrumentation. Homewood's book integrated Selye, Speransky, Verner, and several other models, which led to his neurodynamic model of CVS. *Segmental Neuropathy* was a completely new innovation of chiropractic theory with neurophysiology. Collaboration among authors developed into several new models. Chiropractic vertebral subluxation was viewed as a global neurological phenomenon and a neurodystrophic process. Technique models from Goodheart, Nimmo, Toftness, Ward, Gonstead, Grostic, Gregory, and Pierce laid the foundation for modern practices.

Conclusion: The CVS theories during this period were complex and almost unrecognizable from previous theories. The inclusion of every major theory laid the foundation for this period's wide set of models, research, and methods. (J Chiropr Humanit 2018;25C:99-113)

Key Indexing Terms: Chiropractic; History

INTRODUCTION

The period from 1962 to 1980 in chiropractic was marked by development in chiropractic vertebral subluxation (CVS) models,¹⁻³ research with instrumentation,⁴⁻⁶ and methods of clinical application for CVS correction.⁷⁻¹⁰ Integration between these 3 areas pushed the profession forward. These developments coincided with new educational standards, the first chiropractic accrediting agency to be recognized by the US Department of Education, and inclusion of "subluxation" as the sole diagnosis for chiropractic in the Medicare program of the US Department of Health and Human Services.¹¹⁻¹⁵ All of these factors influenced shaping of chiropractic theories.

I suggest that theory development in chiropractic during these years can be classified into 3 broad groups: academic CVS models, empirical models based on instrumentation to

detect physiological changes associated with CVS, and CVS technic models. Integration of these areas led to increasingly complex neurological models.

The academic theories in this era were mainly developed in texts by Homewood,¹ Weiant,¹⁶ and Harper,¹⁷ and *Segmental Neuropathy*, written by Canadian Memorial Chiropractic College (CMCC) faculty, who were also technic and instrument innovators.¹⁸⁻²⁰ The models from these texts were integrated into technique development for decades. The instrumentation models spanned the profession and were summarized in several papers by Kimmel between 1961 and 1974. Several chiropractic techniques continued to develop independently during this era, such as upper cervical and full-spine models of Grostic, Gregory, Pettibon, Harrison, Gonstead, Cox, Fuhr, Pierce, Stillwagon, Whitehorne, Goodheart, Nimmo, Toftness, and Ward. Most of them combined ideas from the past and integrated some of the latest theories and neurological models.

Understanding the developments of CVS in this era may help interpret other important events from this time, such as the various consensus statements,²¹⁻²⁴ conferences,^{25,26} and histories that emerged.²⁷⁻²⁹ Ultimately, this history may provide another perspective for modern clinical practice and a richer understanding of the importance of CVS theory during this period (Fig 1).

School of Health and Human Sciences, Southern Cross University, Lismore, New South Wales, Australia.

Corresponding author: Simon A. Senzon, MA, DC, 218 E Chestnut Street, Asheville, NC 28801. Tel.: +1 828 251 0815. (e-mail: Simon@institutechiro.com).

Paper submitted May 18, 2016; accepted May 15, 2018.
1556-3499

Copyright © 2018 by National University of Health Sciences.
<https://doi.org/10.1016/j.echu.2018.10.005>

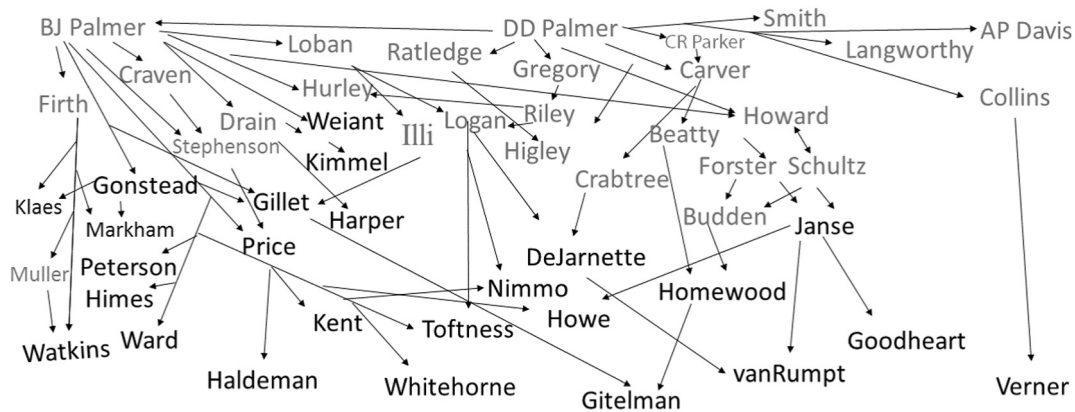


Fig 1. Theorists from 1962 to 1980 with some of their teachers and influencers.

The purpose of this article is to review 3 types of CVS models and to discuss new perspectives that emerged during this era, namely the stress perspective and the neurodystrophic perspective. The discussion section explores commonalities across models, which included the integration of earlier theories and the integration of concepts from Speransky, Selye, and Korr, as well as reflex models and the latest technological innovations.³⁰⁻³⁷

DISCUSSION

Academic Models (1962-1980)

The 4 texts that had the greatest impact on CVS theory from this period were Weiant's *Medicine and Chiropractic*,¹⁶ Homewood's *Neurodynamics of the Vertebral Subluxation*,¹ Harper's *Anything Can Cause Anything*,¹⁷ and CMCC's *Segmental Neuropathy*.³⁸ Taken together, these texts represent a significant development in modeling.

Clarence Weiant. Clarence Weiant completed a degree in chemistry at Rensselaer Polytechnic Institute in 1918 and graduated from Palmer School of Chiropractic (PSC) in 1921. He taught at Texas Chiropractic College (TCC) from 1921 to 1924, during which time Drain was the new president. In 1927, he started teaching at the Eastern Chiropractic Institute in New York City as a professor of chemistry and physiology.³⁹ That same year he proposed that infrared light could detect hyperemia associated with CVS.⁴⁰ Weiant graduated from Columbia University with a bachelor's degree in anthropology in 1937 and a PhD in archaeology in 1943. The Eastern Chiropractic Institute became the Chiropractic Institute of New York (CINY) in 1944.

Weiant was dean of CINY from 1944 until 1966. He became research director of the National Chiropractic Association (NCA) in 1944, which was the predecessor of today's American Chiropractic Association (ACA). From 1945 to 1948, he was head of the Chiropractic Research

Foundation, the research branch of the NCA and precursor to the Foundation for Chiropractic Education and Research, and had his own laboratory facilities.³⁹ In 1953, Weiant and Verner published the second edition of their book *Rational Bacteriology* with R. J. Watkins as coauthor.⁴¹

Weiant developed the Visual Nerve Tracing (VNT) instrument, an infrared photographic instrument, in 1952.⁴² The VNT was based on the Analyte, which he invented with a physicist named Gravelle in 1927.⁴³ The VNT had 2 photoelectric cells, which were placed side by side over the vertebra. Light reflected in the blood vessels of the skin causes the cells to activate. Differences in the degree of vasodilation and vasoconstriction are picked up by the electronic equipment. He proposed that the readings demonstrated that acute CVS could cause inflammatory reactions.³⁷

In 1958, Weiant published *Medicine and Chiropractic* with Goldschmidt, who was a 1922 Carver graduate.^{16,44} In the first chapter, titled "Scope and Purpose of This Book," Weiant explained the improvements in chiropractic theory, research, and education. He wrote of the modern chiropractor, "He is not asked to accept chiropractic on faith. He comes to see it as that science whose field of enquiry is the relation of certain structural defects (particularly of the human vertebral column and pelvis) to functional disturbances and possible pathogenesis."¹⁶ Weiant's conception of chiropractic and CVS were congruent with D. D. Palmer's chiropractic paradigm. Weiant's "functional disturbances" and "possible pathogenesis" were also congruent with the way other chiropractors conceptualized the term "dis-ease" rather than disease. This was a distinction between treating pathology and addressing causes of pathophysiological processes.

The second edition of *Medicine and Chiropractic* was published in 1966, with updated material gathered from New York libraries by Arthur and Joel Goldschmidt. They retrieved over 300 references potentially related to the CVS in the medical and scientific literature.⁴⁵ The text included

some chiropractic references such as books by Forster and Illi^{46,47}; however, many of the references are from Russian and German researchers. One German physician found “the clue to chiropractic theory”⁴⁵ in the work of Pavlov, and another pursued chiropractic because of his interest in Speransky.⁴⁵ The book reviewed literature from Uruguay to the Soviet Union.

In 1964, Weiant summed up the research to that time. He wrote:

The crowning achievement of chiropractic in recent years has been the rigorous reformulation of chiropractic theory. Making use of all relevant modern data from the basic sciences, along with findings of our own major centers of chiropractic research, some of the best minds in our profession have produced a body of theory which no responsible scientist can ignore. It would appear that we are very close to a grand synthesis in this sphere.³

Weiant’s examples of “major centers of chiropractic research” included Illi’s and Janse’s Work, research directed at TCC by Harper, Homewood’s new “formidable” book, and Higley’s research at Los Angeles Chiropractic College on the intervertebral disc.³

A. Earl Homewood. In 1941, Homewood earned a doctor of physical therapy degree from Beatty’s University of Natural Healing Arts. Beatty was Carver’s nephew and Homewood’s mentor. In 1942, Homewood earned his doctor of chiropractic degree from Western States Chiropractic College while Budden (a former dean of National Chiropractic College) was president. In 1945, Homewood was one of the first faculty members of the new CMCC. In 1948, he earned a bachelor of therapeutic arts degree from Western States Chiropractic College. His thesis became the basis for his book. In 1952, he was named dean of CMCC and in 1959, its second president.⁴⁴ Homewood’s book was published in 1962 and went into 3 editions and was reprinted until 1981.¹ In 2015, a new reprint was issued.⁴⁸ Homewood wrote:

A subluxation in the chiropractic sense is not a partial dislocation (less than a luxation), but an alteration of the normal anatomical or physiological relationships, or dynamics, of contiguous structures. Biochemical, biomechanical, pathophysiological, radiological, subjective, and objective symptoms, and other manifestations demand attention, investigation and consideration in depth by every chiropractic physician.¹

Homewood’s definition was congruent with D. D. Palmer’s conception. Homewood made this distinction more explicitly than Palmer could have by using the latest anatomical and physiological literature. Homewood used the term *chiropractic subluxation* to capture that in chiropractic the term *subluxation* is not used by its medical

dictionary meaning but included many factors, such as biochemical, biomechanical, pathophysiological.

Homewood relied on D. D. Palmer’s 1910 text as his base reference and described CVS as vertebrae within their normal range of motion “although not functioning at their optimum.” The term *fixation* captured this disturbance to normal vertebral function.¹ Homewood suggested that D. D. Palmer’s theory of “dis-ease” as too much or not enough functioning was correct. He hypothesized that the CVS excited neural structures, leading to the small intervertebral muscles contracting while the longer and superficial muscles were hypertonic. This allegedly related to an excess of efferent impulses. The tender areas around the CVS were thought to represent increased sensitivity.¹ Homewood acknowledged that the disturbance to neurological function was complicated and difficult to describe and clarify.¹ He wrote:

The writer would emphasize that each phase of the mechanism is but a portion of a complicated, interrelated, interacting, interdependent biological response of the body to a structural disrelation brought about by stresses, either of the external or internal environment or by a combination of many.¹

Homewood attributed the modern chiropractic use of the term *irritation* as the cause of disease to Beatty’s adaptation of D. D. Palmer’s theory.^{1,49} Irritation included any stress or strain from the environment. Mechanical, chemical, or mental stresses were thought to overcome the body’s resistance. This, in turn, was believed to cause CVS or structural distortions that interfered with the transmission of nerve force and irritated the nervous system. Following this line of logic, Homewood stated that the aforementioned processes would lead to disturbances of somatic or visceral function, symptoms, changes in tissues, and ultimately, disease. Homewood’s book contains extensive discussions, which are beyond the scope of this article, about causes and the role of CVS in disease (Fig 2).¹

Homewood integrated Seyle’s stress theory with chiropractic theory.³¹ There was a theoretical connection, which was amplified because Seyle did not write about the role of the nervous system. Homewood wrote, “Selye may be said to have investigated the ‘physiology’ of stress, whereas the chiropractic profession has concerned itself with the ‘anatomy’ of stress.”¹ Homewood also explored the mental and emotional aspects of stress regarding the psychovisceral reflexes in general. He cited Wilhelm Reich in relation to disturbed pelvic posture caused by mental and emotional attitudes toward sex.¹ He also cited Feldenkrais’ insights about decreased respiration, intestinal function, and sexual function in relation to anxiety, muscle tension, and neurotic symptoms.¹ Homewood suggested that these authors were describing elements of psychogenic CVS or those caused by emotional trauma. He also cited D. D. Palmer’s hypothesis that “autosuggestion” was a cause.⁵⁰

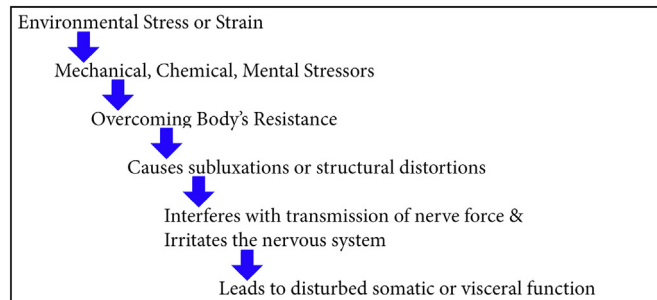


Fig 2. Homewood's model of subluxation etiology.

For patient analysis, Homewood recommended x-ray measurements developed by chiropractic radiologists, palpation, visual inspection, and plumbline analysis, including instruments like the panoramic plumbline posturometer developed at CMCC. He also recommended thermography and dermatomal analysis, especially for chronic CVS, which included the use of the VNT or infrared photographs. Palpation was said to possibly reveal tissue textures from a “slimy” feeling to a “skin-slip” feeling to the cord-like stringiness found with psychogenic CVS. Homewood described muscles associated with a fight-or-flight response as “stringy” with increased hypertonicity upon palpation. He recommended motion palpation and palpation for tender spots, which was related to D. D. Palmer’s method of nerve tracing.⁵⁰

Harper's Irritation Model (1964). William Harper earned a graduate degree in engineering at Massachusetts Institute of Technology in 1933. He graduated from TCC in 1942, during which time Drain was president. Drain recruited Harper to join

the faculty in 1949. Harper started publishing articles about physiology and diagnosis, D. D. Palmer’s model of CVS, irritation of the nervous system, and Speransky’s theory in the 1940s and 1950s.^{51,52} By 1965, when Harper became president of TCC, he had taught every course. In 1980, Janse invited Harper to write an autobiography, which Harper titled *The Man That Chiropractic Developed*.⁵³

Harper published a book in 1964 called *Anything Can Cause Anything*.^{2,52} Harper studied D. D. Palmer’s 1910 text for at least 10 years leading up to the publication of the book. In the book, Harper described D. D. Palmer’s chiropractic models in updated neurophysiological language.¹⁷ The main premise of *Anything Can Cause Anything* was that the environment could irritate the nervous system, which could cause CVS and then lead to impingement. This change was proposed to further irritate the nerves and cause changes in temperature with an increase or decrease of impulses. Normal function would then fall out of time with the needs of the organism. This abnormal function would be expected to lead to pathology (Fig 3).⁵³

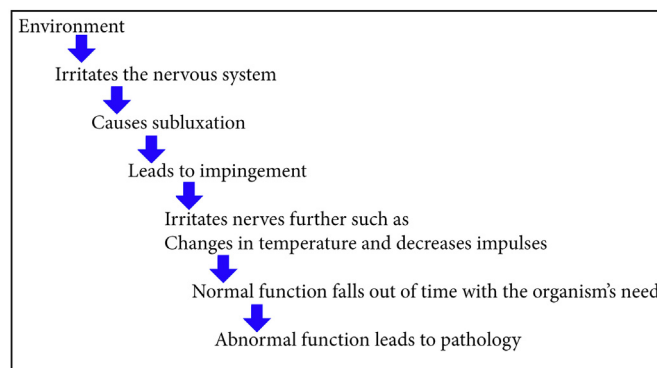


Fig 3. Harper's model of subluxation etiology.

Harper proposed that the irritated nerves could be traced to the vertebral level of the irritating CVS. Other indicators included contracted muscles, pain with movement, and symptoms related to the primary functions. The book contains extensive discussions of diagnosis, chiropractic application, and neurophysiology. Harper wrote:

The subluxation perpetuates disease because it perpetuates the irritation of the somatic afferent fibers in the supporting structures of the articulation, because the subluxation is a change in the environment of the nerves supplying the articulation, and the nerve, because of its property of irritability, gives warning of the change by impulse transmission.²

Harper emphasized that it is not the CVS itself that is of chiropractic concern but the irritation to the nervous system. He wrote, "if the subluxation is not irritating the nervous system, there would be no symptoms."² The irritation was said to cause the symptoms, such as pain, muscle contraction, and a change in visceral function (increased or decreased). If none of these symptoms existed, then there was considered to be no irritation and no reason to adjust the patient.²

Instrumentation Detection of CVS

Between 1962 and 1980, many innovations with x-ray analysis and a proliferation of instrumentation technologies intended to detect CVS occurred. Research into vasomotor activity was prominent.^{4-6,37,42,54} Palpation for heat differentials in relation to CVS patterns extends back to D. D. Palmer.⁵⁵ Instrumentation may have started in chiropractic in 1905, with Oakley Smith's invention of the "locometer," which was used to locate CVS based on marking hypersensitive areas of the spine.⁵⁶ In 1910, B. J. Palmer introduced x-ray analysis. In 1924, he introduced thermographic instrumentation using the neurocalometer invented by his student, engineer Dossa Evins.⁵⁷ In the 1930s, DeJarnette was the first to incorporate the literature on vasomotor activity into the models.⁵⁸ After that period many instruments came and went for the next 40 years.⁴² Some of the instruments were merely commercial ventures, and others were clinically relevant and furthered the CVS theories.⁶

Some instruments had an effect on theory and methodology development.^{42,59-69} Weiant developed his first photoelectric instrument to study vascular changes in 1927.⁴² By 1958, instrumentation had played a large part in his clinical research and CVS modeling.¹⁶ In 1964, Harper cited Weiant's photoelectric research and Gillet's analysis system, which also included instrumentation.^{17,43,70} Thermographic analysis played an important role in Gillet's investigations.⁷⁰ Weiant dedicated his book and his research on pelvic mechanics using x-ray analysis and dissection to

Illi.⁴⁵ Ward also cited Illi's research and expanded on it by including seated full-spine x-ray analysis.¹⁰ Kimmel,⁶ Pierce,⁴² and Peterson⁷¹ each found that thermographic instrumentation demonstrated a cold area that they hypothesized may be indicative of the CVS. The synchro-therme was an instrument developed by Peterson and studied at CMCC by Haldeman.⁵⁴ The text developed by CMCC in 1965 was used as the manual for synchro-therme trainings.¹⁸ Other technique developers relied on instrumentation and x-ray analysis, such as Nimmo,⁸ Toftness,⁹ Grostic,⁷² Gonstead,⁷³ Pierce,⁷⁴ and Ward.¹⁰

The scientific accuracy of instrumentation was reviewed by Kimmel starting in 1961.⁴⁻⁶ Edwin Kimmel attended CINY in 1949 at the height of Weiant's leadership in chiropractic research.⁷⁵ Kimmel was the research director for the NCA's Council on Psychotherapy from 1952 to 1964 and chairman of the Education Committee of the Chiropractic Association of New York. He was also a member of the New York Academy of Sciences and published articles for 45 years on chiropractic.⁷⁵ According to Weiant, Kimmel was "one of the driving forces in the political maneuvering that would force a re-write of the constitution and bylaws of the new ACA at its tumultuous convention in Denver in 1964."⁷⁵ He became a state delegate from New York of the new ACA in 1965.⁷⁵ Kimmel was on the faculty of CINY until its demise in the 1960s. He was an adjunct faculty at the Columbia Institute of Chiropractic (precursor to New York Chiropractic College) in the 1970s.⁷⁵ Between 1961 and 1974, Kimmel wrote several articles on instrumentation designed to detect CVS.⁴⁻⁶

In 1961, Kimmel critiqued 3 classes of chiropractic instrumentation.⁴ The first group included the thermoelectric instruments, the second group included bioelectric instruments, and the third group included photoelectric instruments (Fig 4). In the article, Kimmel suggested that there were several indications of the irritation caused by CVS, including redness, swelling, heat, pain, and local or distal functional impairments. He cautioned practitioners to use the best scientific evidence when interpreting data.⁴

In 1966, Kimmel updated his insights on the latest instrumentation in hopes of assisting practitioners in avoiding instruments that were not scientifically validated and embracing the best technological advancements in the field of bioelectronics.⁵ One of the main criticisms was not at what the instruments measured but on claims made based on interpretations. After almost 15 years of researching and writing on the topic, Kimmel wrote:

For a good many years we have been trying to justify, substantiate and validate chiropractic as a scientific discipline. Many of us realize that the need for valid instrumentation in modern chiropractic practice becomes more obvious as time progresses. It is well known that precise measurements are a necessary and basic part of the scientific doctrine. In

Thermo-electric instruments	Bio- electric instruments	Photo-electric instruments
NCM, neurocalograph, chirometer, analagraph, Thermo-scribe, Dermo-scope, Thermo-o-meter, Calor-o-meter, Super thermos-meter, Pyrometer, Neuro-pyro-meter, Universal skin thermometer, Magnetic skin thermometer.	Micro-dynameter, Rx-Microtabulometer, Psychgalvanometer, Clinical Dermohmeter, Polygraph, Micro-neurometer, Psychroneurometer, Electro-psychometer, Index-o-meter, Neuro-micrometer, Bio-neurometer, Neuro-psychometer, Bio-electrometer, Analytic pocket PH meter, Galvano-psychometer, Nervoscope.	Spectro-photometer, the Colorscope, the Analyte, the Colorimeter, the Mercury-quartz light, the Ultraviolet light source, the Visual Nerve Tracing Instrument, the Photronic Dermatone Analyzer

Fig 4. Kimmel's 3 classes of chiropractic instrumentation.

the past we have been somewhat naive in our quest for qualitative analytical information. We have allowed ourselves to be misdirected and misinformed by the dubious claims made by opportunistic manufacturers. Despite the fact that the most recent advances in scientific electronic technology may have been utilized in the manufacture of these instruments, up to now the validity of the findings has never been proven by dedicated, qualified, unbiased research. The chiropractors who have purchased these instruments have placed a great deal of value upon the findings, and as a result the entire profession is subject to criticism.³⁷

In the series, Kimmel presented his own thermoelectric research, which pointed to cold spots rather than hot spots as the point of vasomotor constriction that he thought were associated with CVS. He suggested that subclinical irritation can cause slight inflammation. For thermography and the sympathetic response to the irritation caused by the CVS, Kimmel suggested the inflammation may be a hot or cold subclinical tissue response.^{5,6,37}

In summing up his findings, he acknowledged that there was much more research to do to adequately demonstrate instrumentation's role in chiropractic. Nevertheless, he concluded that although more research was warranted, "There seems to be an increasing amount of evidence which supports the value of chiropractic instrumentation."⁶ He concluded that thermographic changes and unipolar thermoelectric instruments needed more investigation. He also suggested that the profession was being "hypercritical" about bioelectric instruments by dismissing them without

conducting proper scientific research. To the skeptics in the profession, he recommended that clinical information could be gathered with these instruments within limitations although chiropractors should continue to pursue scientific evidence, including the reporting of positive and negative results of research findings.³⁷ Kimmel was the first in the profession to reference R. O. Becker's early work on the bioelectric field around the body generated by the brain and cord.⁷⁶ Kimmel increased the level of academic standards in the field of chiropractic instrumentation.

Segmental Neuropathy (1965). *Segmental Neuropathy* was a book published by CMCC in 1965, with Peterson, Watkins, and Himes as the primary authors (Fig 5).³⁸ In 1962, Watkins had returned to CMCC after becoming one of the first diplomates in roentgenology.²⁶ He soon became chairman of the departments of technique, x-ray, diagnosis, and clinics, as well as assistant dean. Watkins oversaw the neurological aspects of the book.³⁸ Himes was a 1931 Palmer graduate and was named the head of the technique department at PSC in 1953, director of student clinics in 1958, and director of all Palmer clinics from 1959 to 1961. He became dean of CMCC in 1962.⁴⁴ Himes brought the Palmer philosophical perspective to the text. Himes invited an old Palmer associate, A. R. Peterson (a 1947 graduate of PSC), to join CMCC.⁷⁷ Peterson was the first author on the book.³⁸

Peterson developed a model of vasomotor regulation in 1964.⁷⁸ He hypothesized that the regulation was mediated through the sympathetic system spanning across specific zones corresponding to vertebral segments. Watkins wrote that this thermal regulation could be monitored as a "window into the inner workings of the nervous system,"²⁶ an extremely



Fig 5. *The first synchro-therme seminar Canadian Memorial Chiropractic College faculty: Shrubb, Watkins, Peterson, and Himes. Image from the May/June 1965 issue of Digest of Chiropractic Economics and used with permission.*

sensitive indicator of early neural dysregulation. Hence the subtitle of the book: “The First Evidence of Developing Pathology.”³⁸ The vasomotor model included the hypothesis that CVS created a cold spot rather than a hot spot, as had been postulated in earlier works by other authors. This was also what Kimmel found, and it was the exact opposite of the Palmer “nerve-heat” concept associated with the neurocalometer.^{26,37,50,79}

Peterson, Watkins, and Himes taught a seminar series called “Vasomotor Monitoring,” which was based on learning to use the synchro-therme.⁷¹ The synchro-therme was developed by Peterson to independently measure bilateral thermographic radiations along the spine.²⁶ *Segmental Neuropathy* was developed for the course (Fig 6). The book integrated concepts from Speransky and Seyle with the principles of chiropractic without directly referencing either source. The text emphasized the integrated balance of health. The delicate balancing act of adaptation to the environment required an “intelligent” pattern.³⁸ Adaptation was viewed as adequate neural control. The inability to adapt, which could relate to any and every pathophysiology, ultimately represented less neurological control. The CVS was viewed as a “symptom of neural dysfunction” and a “cause of neural dysfunction.”³⁸ This reflex pattern was proposed to perpetuate itself in the nervous system in abnormal ways as a segmental neuropathy. According to this theory, the segmental integrity of the nervous system was the key to CVS, the quality of the nerve impulse, and the interaction of many reflex systems. Further, the authors wrote that the chiropractic adjustment disrupts the neuropathic process. They wrote:

Unless advances are made beyond old mechanical concepts, into concepts embracing the neurological factors associated in the disease process, one finds it difficult, if not impossible to explain the great paradox of chiropractic – that different adjusting techniques, based on conflicting premises, often produce the same impressive clinical results.

The vertebral subluxation becomes more subtly understandable when viewed as a symptom of an aberrant postural reflex, which is normally inter-segmentally associated through nerve networks located on each spinal cord level. Such sensory-motor neural control must be totally integrated to produce coordinated motion in the spinal column as a whole unit. The etiology of the vertebral subluxation may well be physiological or mechanical trauma to the proprioceptive fibers, a neurological insult to the nervous control mechanisms servicing the articulation. This action would result in a deranged appreciation by the appropriate spinal and cerebral centers of the position in space of the respective vertebrae.³⁸

They suggest that by understanding the complexity of the neurology associated with CVS, one can then understand the positive results often associated with so many different chiropractic methodologies.³⁸



Segmental Neuropathy

Fig 6. The cover of *Segmental Neuropathy* online edition.³⁸

Technic Models

Clinical innovation became both a strength and a fault for chiropractic. The strength came from tested methodologies that were reproduced by practitioners.⁷⁴ One of the faults was the economic incentive for technic instructors to sell their method, and another was the lack of research and research culture related to funding.⁸⁰ And yet, many technics that emerged during this period continue to be used in current clinical practice. A few examples demonstrate how these methodologies further increased the complexity of the definition of the CVS.

Groscopic's Model. By the 1960s, there were new research organizations exploring work originally developed by J. F. Grostic, a 1933 PSC graduate. After a neck injury in 1935 to which Grostic ascribed a relapse of Hodgkin's lymphoma, Grostic became a patient of B. J. Palmer's at the B. J. Palmer Research Clinic. His recovery under B. J. Palmer's care inspired him to investigate upper cervical analysis and chiropractic care. He was a founding member of the Palmer

Standardized Chiropractors Council in 1937. Palmer Standardized Chiropractors Council members shared their clinical research and notes in hopes of standardizing methodology.⁸¹

By 1939, Grostic taught his own procedure as a way to systematize the types of analysis that were implicit in B. J. Palmer's model but up until that point were difficult to teach. Grostic's procedure was based in part on pre and post x-ray analysis, which were taken during an initial exam and then again after the adjustment. For example, after examining the results of 80 pre and post x-rays, he modified his procedure to emphasize precision based on mechanics, mathematics, and physics. He developed x-ray procedures to reduce patient exposure and maximize clinical results, and procedures of patient setup and x-ray measurement techniques led to new methods for determining atlas laterality as well as axis and occipital condyle angles and occipitoatlantal rotation. He developed a supine leg check to help determine neurological interference. By 1957, Grostic developed an adjustment procedure that included a light thrust.⁸¹

Upper Cervical Models. The branches of upper CVS correction methods, which started with B. J. Palmer in the 1930s, developed into 3 streams during this period.⁷⁴ Most of the upper cervical analysis and correction models were developed from students of Grostic and B. J. Palmer. Orthospinality technique adhered mainly to Grostic's original models, although it used an instrument to adjust, whereas Grostic used his hands. Orthospinality was taught at several chiropractic colleges.^{74,81} The National Upper Cervical Chiropractic Association was started by Ralph Gregory. Gregory was a 1939 PSC graduate and a student of Grostic. By 1969, Gregory concluded that his 25 years of clinical observations demonstrated every distortion of the full spine and pelvis originated from an upper cervical subluxation.⁸² The National Upper Cervical Chiropractic Association had published a monograph with research findings since 1973. Atlas Orthogonal technique was started by Roy Sweat in 1981 and was taught at several chiropractic colleges.

Full-Spine Models. Several full-spine technic developers, such as Pettibon and Harrison,⁷⁴ were descendants of the hole-in-one technic.⁷⁴ Pettibon viewed the entire spine as a functional unit and that the goal of chiropractic should be to relate "the subluxated spine optimally to its environment."⁷⁴ He developed a full-spine x-ray analysis system based on the biomechanical view of spinal posture. Harrison developed chiropractic biophysics after he stopped working with Pettibon in 1980.⁷⁴ Pettibon and Harrison followed the postural school of thought initiated by Carver.⁸³ Harrison and his students developed a mathematical modeling of what he considered the "ideal" spine.⁷⁴

Gonstead's Model. The Gonstead seminars were launched in 1954 by Ted Markham and Marv Klaes, who were the first instructors of Clarence Gonstead's methods.⁸⁴ Both studied under Firth and were Lincoln Chiropractic College

graduates. It is likely they applied Firth's disc theories to explain Gonstead's methods.⁸⁵ Gonstead learned the Palmer Technic system from Firth and others during the 1920s.⁸⁶ Gonstead used instrumentation and x-ray analysis coupled with extensive clinical practice to develop his own methods and analysis.⁸⁴ Gonstead expanded on his discopathy model of CVS theory after conducting cadaver studies at Lincoln Chiropractic College. His model was based on stages starting with fixation, then misalignment, which he proposed would lead to disc damage and then nerve interference.⁷⁴

James Cox's Flexion-Distraction Approach. James Cox, a 1963 graduate of National Chiropractic College, developed a model of spinal dysfunction that is based on vertebral movement and intervertebral disc function. It is not clear whether Cox uses the term *subluxation* in his model. He has incorporated concepts from a traction table originally developed by McManis in 1918 for the osteopathic profession. Cooperstein and Gleberzon wrote that the flexion-distraction approach was designed to "improve vertebral motion and positional relationships, free up longitudinal adhesions, relieve nerve root pressure, separate the facet joints, improve circulation in and around the intervertebral foramina, improve metabolite transport into the disks, and reduce hydrostatic pressure in the disks."⁷⁴ Many of these elements were congruent with elements from other models.⁷⁴

Fuhr's Model. Arlan Fuhr graduated from Logan College of Chiropractic in 1961. His model includes theories of Logan, Derifield, Thompson, and Van Rump. ⁷⁴ Fuhr's model is that the segment is hyperirritated, especially the anterior and inferior sacrum, which leads to contracture of paraspinal muscles, which leads to a short leg. Biomechanical torsion of the pelvis is thought to cause a facilitation of the muscles as a result of CVS.^{74,87} Fuhr developed an instrument called the Activator to deliver the thrust of an adjustment.

Pierce, Stillwagon, and Whitehorne's Model. Pierce, Stillwagon, and Whitehorne developed a model in the 1960s that had roots in the thermographic pattern analysis developed at the Palmer School of Chiropractic and J. Clay Thompson's full-spine approach.⁷⁴ Whitehorne was dean at Columbia Institute of New York. Pierce and Stillwagon each had private clinics and taught postgraduate seminars with Whitehorne.⁸⁸ The model is usually attributed to Pierce and Stillwagon. However, it was Whitehorne, a 1947 PSC graduate, who brought the upper-cervical perspective to the model. For this reason, Epstein, who was a student of the 3, suggests that it should truly be referred to as Pierce-Stillwagon-Whitehorne technic.⁸⁹

Their methods of CVS detection included leg checks, x-rays, palpation, and instrumentation. Thermography was used to measure physiological changes, and the other methods were used to detect anatomical changes.⁷⁴ In their full-spine approach, CVS of the cervical and pelvic spine

were viewed as causes of compensations in the lumbar and thoracic spine. They emphasized CVS of C1, C2, C5, and the pelvis including the sacrum. They hypothesized that correction of CVS was to restore normal function to the autonomic system and normalize blood flow in the tissues, which was determined by changes in the thermographic patterns.⁷⁴ In 1963, Pierce developed the dermathermograph, which was a single-probe infrared device. By 1983, it was modified to the DT-25. Stillwagon developed the Visi-Therm.^{42,74}

Goodheart's Applied Kinesiology (1964). In 1964, George Goodheart, Jr. presented his first seminar on applied kinesiology (AK).⁷ The seminar notes were brief, with only 7 pages of text supplemented by instructions on testing specific muscles from Kendall and Kendall's text, *Muscles: Testing and Function*.⁷⁸ Goodheart recounted his innovative discovery that in musculoskeletal imbalances the primary fault is not the hypertonic muscle spasm, but instead lies in the hypotonic weak antagonist. He also described his discovery of nodules at the origin or insertion of these weak muscles and how he found that applying heavy pressure on these nodules almost immediately strengthens the weak muscle. This was the original origin-insertion technique and was the entirety of AK in 1964.⁷

The remainder of the original seminar notes described the use of manual muscle testing to locate the weak muscle and identify the origin and insertion for the site of technique application. Goodheart emphasized observation of postural patterns. The foreword states: "A chiropractic analysis consists of many things, but it consists first and foremost of what we see. Second, what we feel, and third, what the x-ray, tells us. What you feel is of great importance, but what you see is of even greater importance."⁷

He added the use of muscle testing as an indicator of physiologic response to not only locating the site of CVS through a vertebral challenge of the intrinsic muscles, but to identifying the ideal line of drive and, after the adjustment, to test whether or not it was effective.⁷ Under different names, the use of manual muscle testing to evaluate functional response has since spread beyond the profession to a variety of disciplines.⁹⁰

Nimmo's Theory (1973). Raymond Nimmo was a 1926 PSC graduate. He studied Logan Basic technique in 1935. In the 1940s and 1950s he developed his own methods, which integrated his study of fascia release and Travell's trigger-point work. In 1973, Vannerson and Nimmo proposed that CVS was a neuropathic process involving at least 1 segment of the spine. They suggested that CVS were not fixations but "sensitive areas"⁸ with a lowered threshold of facilitation. The misalignment was thought to be secondary to the vicious and chronic neural process activating the hypertonic muscles. Vannerson and Nimmo preferred the term *noxious generative points* to the term *subluxation*.^{8,74} This is another proposed change to

terminology, although Cooperstein and Gleberzon considered their term synonymous with subluxation.⁷⁴

Toftness' Model. Irving N. Toftness was a 1928 graduate of PSC. He started as a hole-in-one practitioner as proposed by B. J. Palmer and then embraced Logan Basic technique. Toftness eventually integrated the 2 with a focus on C1, C2, C3, C4, and the sacrum. Toftness included several of D. D. Palmer's concepts in his rationale, such as that the neuroskeleton was a regulator of tension, which was integrated into his stress theory.⁹ According to Toftness, the excitation caused by the CVS was transmitted to the brain as nerve stress or nerve energy, which led to disease. Toftness believed that CVS moved around the tension frame as a type of adaptation to stressors. Until the stress was gone, the body would shift the stress from one articulation to another. He posited that CVS gave off detectible energetic radiations and developed the Toftness Radiation Detector as the central part of his analysis.⁹

Ward's Spinal Stress Model (1980). Lowell Ward graduated from the PSC in 1959 when B. J. Palmer was president. Ward's spinal stress model was an integration of chiropractic theory including Illi's work, Selye's stress model, and Breig's biomechanics of the central nervous system.¹⁰ Ward was among the first within chiropractic to take up Selye's call to develop ways to measure stress and also one of the first to integrate Breig's paradigm of spinal cord biomechanics into practice.⁹¹ Ward used thousands of pre and post x-rays to develop a postural assessment analysis that led to the creation of his spinal stressology technique.¹⁰ Pre x-rays were taken on initial exam and post x-rays were taken after the care plan was complete.

Ward worked with an aerospace engineer named Fulkerson starting in 1966⁹² to develop a measurement system designed to detect Selye's stages of stress in the spinal system. The 4 levels of spinal stress were alarm, resistance, exhaustion, and irreversible exhaustion. He viewed the spine's reaction to stress as 1 functional unit and developed several postural typologies that he suggested were related to personality typologies.¹⁰

Ward proposed a change to CVS terminology. Instead of using the term *subluxation*, he felt that the profession should use *biomechanical dysfunction*. Subluxation, according to Ward, occurred in the spinal column-pelvic-meningeal system. He considered CVS as an "intra-spinal vertebral stress fixation."¹⁰ He also considered it "any vertebra within the spinal column that is fixed in a position that turns the spine away from its vertical center line as seen on the anterior-posterior x-ray view."¹⁰

Ward considered a lack of spinal integrity to be a loss of wholeness for the spine. When spinal column integrity was lost, the spine, nerves, and body must adapt and continue to function, often to deal with stressors. Ward felt that over time stress accelerators lead to destructive breakdown.¹⁰ Ward postulated that spinal column primary stressors included trauma, neurological overloading, and structural

malformations. Secondary stressors included atlas position being compromised and coccygeal dysfunction. He proposed that these 2 distal ends of the spine were the first to respond to primary stressors and then act to initiate new stressors. Other secondary stressors were thought to be imbalance of muscles and ligaments, functional short leg, and "spine-spinal cord behavioral stress patterns."¹⁰ He considered the functional short leg to be an indication of spinal cord meningeal stress fixations and integrated with Breig's paradigm of dynamic cord length.¹⁰

Goodheart endorsed Ward's stressology. He wrote:

To me, Dr. Ward's system of x-ray analysis in his suggestion that the total spinal column pelvic unit should be observed and measured is the "sine quanon" of the profession.

In fact, I think Dr. Ward's spinal column stressology is possibly the most unique concept variation that has been developed within all our profession. The concept that the total spine has the potential of increasing and decreasing in spinal length as well as the relative fixed positioning that can be both observed and quantified will fit very closely into and correlate with the Applied Kinesiology Approaches.¹⁰

Ward may have been the first in the chiropractic profession to study the adaptive change from standing to seated spinal posture using x-ray analysis. Ward hypothesized that the spine should adapt synchronously in both positions and that not doing so was indicative of dysfunction and meningeal tension.¹⁰

New Perspectives

At least 2 new CVS perspectives emerged during this era: the stress perspective and the neuropathic perspective. Like other new perspectives, including the instrumentation perspective, once they became adopted by the profession, CVS theory and CVS models were changed. Any discussion after this period that does not include these new perspectives would be incomplete because it would neglect the increasingly complex ways the CVS was accepted and integrated into the profession.

The Stress Perspective. The first mentions of Selye's works in the chiropractic literature were written in the 1950s by Muller, Verner, and Del Pino.⁹³⁻⁹⁵ All 3 acknowledged that chiropractic theory contributed to the stress literature by including the role of the nervous system. Homewood noted that Selye discovered the physiology and chiropractic the anatomy of stress.¹ Toftness also used stress models to understand how CVS moved from place to place on the neuroskeleton tension framework.⁹ This was an integration of D. D. Palmer's models with Selye in a novel way.

Ward included a measurement system to observe the stages of stress on the spine.¹⁰ He also modeled the stress response for the spine as a psychophysical functional whole. Ward's concept of the spinal system as a circuit responding to overload cited B. J. Palmer's original use of that metaphor in 1907 and republished in 1920.^{10,96} Ward integrated stress models of the spine with Breig's biomechanics of the spinal cord and a dynamic x-ray analysis.^{10,91}

Ward also foreshadowed the theory of allostasis, which updated homeostasis models and coupled them to stress loading and the nervous system.^{10,97,98} Ward's concept of neurological overloading, which was multifactorial, is consistent with the way overloading is used in allostatic theory.^{10,99} Allostasis is an important research paradigm for the chiropractic profession to explore.

The Neuropathic Perspective. Peterson, Himes, and Watkins integrated their findings with the models of Speransky and Selye.³⁸ They thought that the cold areas of the spine indicated neuropathic lesions that were self-perpetuating and initially protective. This model of the protective nature of the CVS (because of dysfunctional neurological reflex systems and stress) extends back to D. D. Palmer. Their approach was integrated with the models that developed in the PSC under B. J. Palmer.^{79,100}

Common in the works of Verner, Weiant, Homewood, and Harper, and *Segmental Neuropathy*, was a view that CVS was both a symptom of neural dysfunction and a cause of neural dysfunction.^{1,2,38,45,93} Homewood took D. D.'s theory of the excitation of neural structures and linked it to the reflex and proprioceptive models already suggested by Verner, Heintze, Watkins, and Janse.^{1,34,93,101,102} Homewood wrote that "The tender areas around the subluxation represent increased sensitivity."¹ According to many of the theorists, this led to contracted musculature, which was often unilateral, leading to a short leg reaction. Phillips wrote about this as a flexor reflex or "an irritable reflex mechanism."³³ Harper pioneered the integration of D. D. Palmer's use of irritation and also described a neuropathic perspective of CVS.⁵⁰ The inclusion of Korr's facilitation perspective was soon integrated with the neuropathic perspective, which led to the most advanced models to date. As Watkins noted in 1966, the neuropathy precedes the neurodystrophic process.

Analysis

The period from 1962 to 1980 demonstrated a new level of maturity in models of CVS theory. Perspectives from the past were integrated with the latest perspectives on Selye's stress syndrome, Korr's facilitation hypothesis, and research from other fields, which included neurophysiological and pathophysiological concepts. Reflex models and Korr's facilitation hypothesis influenced several technique and CVS models from academics. Biomechanical perspectives were highlighted in technique developments of this

era. Instrumentation shaped the theories as well. The neurodystrophic perspective was included in most of the major texts. Other commonalities that should be highlighted were the influence of Speransky, Selye, and Korr; the impact of Verner and the Palmers; the thought-leadership of CMCC; and a new focus on CVS terminology.

The concepts from Speransky and Selye had been integrated into the chiropractic literature since the 1930s.^{26,95,103-106} In these theories, chiropractors found congruence of Selye's work with the chiropractic paradigm. Early chiropractic was criticized for, among other things, holding a unitary concept of disease: interference with the nervous system. Speransky and Selye put forth just such concepts.^{30,31} Selye was an endocrinologist and originally thought the stress response was solely hormonal.³¹ He eventually conceded the nervous system or endogenous mentally generated stress was the main driver.¹⁰⁷ Selye and Speransky had become commonplace in the chiropractic literature by the 1950s,^{94,95} and both were integrated into technique models during the 1970s.^{9,10}

Even though reflex models of adjusting had been used in chiropractic since the 1930s,^{108,109} these models reached new levels of complexity between 1962 and 1980 based on the integration of the latest neurophysiology.^{33,35,110,111} Reflex models had an effect on theories and technique development by chiropractors such as Watkins²⁶ and Goodheart.⁷

Korr was an osteopathic researcher whose research focus was congruent with chiropractic theory, namely the reflex mechanisms associated with CVS. Korr integrated reflex models and was inspired by Speransky, when he developed the concept of the "facilitated segment" to account for neural consequences of spinal "lesions" based on experimental observations that he made with Denslow.^{32,112} Korr's facilitated segment was adopted by chiropractors and integrated with other theories and clinical applications.^{8,25}

The impact that B. J. Palmer had on theories from this period is not obvious by studying references in textbooks. Some theorists appear to have used B. J. Palmer's ideas but did not include references to him. Ideas that seem to have been B. J. Palmer's were attributed to other sources. Direct influence from B. J. included his influence on the models of his students, including Grostic, Whitehorne, Himes, Nimmo, Toftness, Ward, Gregory, Peterson, and Weiant. Most of these PSC graduates broke from B. J. Palmer's theories in some way. Several indirect influences could be inferred through second-generation students, such as Watkins and Muller, who studied under Firth, and Harper, who studied under Drain.

Indirectly, B. J. Palmer had an effect on other theorists. For example, Harper's text contains a notable lack of reference to B. J. Palmer even though he cited other chiropractic authors including D. D. Palmer, Drain, Janse, Firth, Weiant, Verner, Gillet, Kimmel, and Muller.¹⁷ Harper

equated D. D.'s concept of tone to irritability. However, he mistakenly attributed the simple cell cycle to D. D. Palmer rather than B. J. Palmer. Harper described the process of sensory input, impulse transmission to the brain, interpretation, and function. This describes B. J. Palmer's cycle of life and parts of his normal complete cycle.^{96,113} Perhaps Harper learned of the cycle from Drain, his mentor. Drain studied with both Palmers and quoted from their books.¹¹⁴ According to Jim Russell, a 1949 TCC graduate, B. J. Palmer's books could not be found on campus in the 1940s.¹¹⁵ Harper's book was a standard reference in the literature during the 1960s to 1980s.¹¹⁶ Harper's line of thinking is a development of D. D. Palmer's thinking, but it also integrates Drain's perspective, which was mostly developed from B. J. Palmer, who emphasized the interference rather than the irritation.

In some instances, the only way to truly know of B. J. Palmer's impact is to understand the history of ideas in chiropractic. For example, like Harper, Homewood did not reference B. J. Palmer.¹ However, he described the interference model of CVS and the cord pressure model. Both were originated by B. J. Palmer.^{96,113,117} It is possible that he was unaware of B. J. Palmer's early writings on these topic because his teachers were Beatty and Budden, both of whom came from schools that were rivals of B. J. Palmer's school.

One technique manual and 3 major texts were authored by CMCC faculty members between 1948 and 1965. First was the CMCC technique manual that was a collaboration of Watkins, Homewood, and other faculty.¹⁹ The 3 books included Muller's *Chiropractic and Autonomics*,⁹⁵ Homewood's *Neurodynamics of Vertebral Subluxation*,¹ and Peterson and colleagues' *Segmental Neuropathy*.³⁸ CMCC was the first professionally owned school, which meant that it was a not-for-profit and governed by a board. The initial goal was to hire the best faculty. Muller, Watkins, Himes, Homewood, Peterson, Gitelman, Faye, and Haldeman all contributed to the thought leadership of the profession. Haldeman noted in 1973 that this school more than any other was influenced by Verner.²⁸ Collaborations and papers from CMCC spread to other institutions and the entire profession well into the 1990s.

In 1965, DeJarnette, the developer of sacro-occipital technique and author of several chiropractic texts,^{58,109,118} recommended that the profession stop philosophizing about the existence of CVS and continue to determine what constitutes it, because it "has become the Rock of Gibraltar of this profession."¹¹⁹ This attitude was common from 1962 to 1980 and was born of new levels of sophistication of theories and maturation of techniques.^{1-3,7-10,24,26,27,74}

One of the first calls in the literature to remove the term *subluxation* was first published during this time. It came in a letter to the editor from P. E. Brown in a 1966 issue of the *ACA Journal Chiropractic*.¹²⁰ He wrote, "The term as used is an incorrect one! ...Why not discard the term once and for all and use acceptable, understandable language that is used in the healing arts field?"¹²⁰ Not much biographical data exist in the literature about Brown except that he

received the ACA Meritorious Service Award in 1975.¹²¹ According to his argument, chiropractors were using the word incorrectly by defining it neurologically because the medical dictionary definition of *subluxation* means "partial dislocation." His critique may have been a response to DeJarnette.¹¹⁹ Nevertheless, his suggestion that aimed to bring the profession's lexicon more in alignment with orthodox medicine and the accepted scientific literature seemed to be influential. Although Brown is not known to be the originator of the movement to stop using the term, by the 1970s some academics, researchers, and theorists were developing alternative terminology to describe the CVS.^{27,122-125}

Limitations

This work is limited by the interpretations of the author. Others may analyze this material differently and derive alternative conclusions. The paper is also restricted by the availability of literature from the period. Systematic methods of literature searching using a standard set of terms and Boolean operators would have been more reproducible methods and may have yielded more literature.

CONCLUSION

This period was prolific for new CVS models, driven by integration of scientific theory and commercial investments in instrumentation to detect CVS. The theories between 1962 and 1980 laid the foundation for many major theories of the modern era. Texts from Weiant, Homewood, Harper, Peterson, Watkins, and Himes formed a new theoretical framework for modern chiropractic based on previous theory leading back to D. D. Palmer. Technique developments during this time innovated on traditional models such as upper cervical and full-spine adjusting and also integrated new theories, such as Selye's stress theory and Breig's biomechanics of the central nervous system. By understanding the models from this era, a foundation for modern chiropractic theory and practice may be established. Research into the hypotheses, instrumentation protocols, and assessment methods may still prove fruitful in the profession because new research designs could be applied to CVS models from the past.

ACKNOWLEDGMENTS

The author acknowledges Brian McAulay, DC, PhD, David Russell, DC, Stevan Walton, DC, and the Tom and Mae Bahan Library at Sherman College of Chiropractic for their assistance.

FUNDING SOURCES AND CONFLICTS OF INTEREST

The author received funding from the Association for Reorganizational Healing Practice and the International Chiropractic Pediatric Association for writing this

series of papers. No conflicts of interest were reported for this study.

CONTRIBUTORSHIP INFORMATION

Concept development (provided idea for the research): S.A.S.

Design (planned the methods to generate the results): S.A.S.

Supervision (provided oversight, responsible for organization and implementation, writing of the manuscript): S.A.S.

Data collection/processing (responsible for experiments, patient management, organization, or reporting data): S.A.S.

Analysis/interpretation (responsible for statistical analysis, evaluation, and presentation of the results): S.A.S.

Literature search (performed the literature search): S.A.S.

Writing (responsible for writing a substantive part of the manuscript): S.A.S.

Critical review (revised manuscript for intellectual content, this does not relate to spelling and grammar checking): S.A.S.

Practical Applications

- This series of articles provides an interpretation of the history and development of chiropractic vertebral subluxation theories.
- This series aims to assist modern chiropractors to interpret the literature and develop new research plans.

REFERENCES

1. Homewood AE. *The Neurodynamics of the Vertebral Subluxation*. 3rd ed. Homewood; 1981.
2. Harper W. *Anything Can Cause Anything: A Correlation of Dr. Daniel David Palmer's Principles of Chiropractic*. 4th ed. Pasadena, TX: Texas Chiropractic College; 1997.
3. Weiant C. Our proliferating techniques: an urgent professional problem. *ACA J Chiropr*. March 1964;28-29.
4. Kimmel E. Electro-analytical instruments used in chiropractic practice: A re-evaluation of the merits of some apparatus used in analysis or diagnosis. *J Natl Chiropr Assoc*. February 1961;28-31.
5. Kimmel E. Instrumentation. *ACA J Chiropr*. June 1966;11-14, 49-52.
6. Kimmel E. Electro analytical instrumentation: Part 1. *ACA J Chiropr*. 1972;VI(S-33).
7. Goodheart GJ. *Applied Kinesiology*. Detroit, MI: Goodheart; 1964.
8. Vannerson J, Nimmo R. Specificity and the law of facilitation in the nervous system. *Receptor*. 1971;2(1).
9. Toftness I. *Philosophy of Chiropractic Correction*. I.N. Toftness, DC, PhC; 1977.
10. Ward L. *The Dynamics of Spinal Stress: Spinal Column Stressology*. 3rd ed. Long Beach, CA: SSS Press; 1980.
11. Keating J, Callender A, Cleveland C. *A History of Chiropractic Education in North America*. Association for the History of Chiropractic; 1998.
12. Senzon S. Chiropractic professionalism and accreditation: an exploration of conflicting worldviews through the lens of developmental structuralism. *J Chiropr Humanit*. 2014;21(1):25-48.
13. Gibbons R. The rise of the chiropractic educational establishment: 1897-1980. In: Lints-Dzaman F, Scheider S, Schwartz L, eds. *Who's Who in Chiropractic International*. Littleton, CO: Who's Who in Chiropractic International Publishing Co.; 1980.
14. Harper W. Medicare: the implication, the effect and impact on the future of the chiropractic profession. *Dig Chiropr Econ*. 1973;20-25.
15. Rutherford L. *The Role of Chiropractic*. Eugene, OR: Health Education Pub. Corp.; 1989.
16. Weiant C. *Medicine and Chiropractic*. 1st ed. New York, NY: Chiropractic Institute; 1958.
17. Harper W. *Anything Can Cause Anything: A Correlation of Dr. Daniel David Palmer's Principles of Chiropractic*. Texas: William D. Harper; 1964.
18. Petersen AR, Watkins RJ, Himes M. *Segmental Neuropathy: The First Evidence of Developing Pathology*. Toronto, Ontario: Canadian Memorial Chiropractic College; 1965.
19. Watkins RJ, Greenshields C, Lee H, Wynn R, Homewood AE. *A Text-book of Chiropractic Technique*. Toronto, CA: Canadian Memorial Chiropractic College; 1948.
20. Himes H. Palmer school clinics: Part III. *ICA Rev*. 1960;8-10.
21. Gatterman M. *Foundations of Chiropractic Subluxation*. 2nd ed. St. Louis, MO: Mosby; 2005.
22. The ACC chiropractic paradigm. 1996; Available at: http://www.chirocolleges.org/paradigm_scope_practice.html. Accessed September 10, 2010.
23. Howe J. Preliminary observations from cineroentgenological studies of the spinal column. *ACA J Chiropr*. 1970;IV(S-65).
24. Bittner H, Harper W, Homewood A, Janse J, Weiant C. Chiropractic of today. *ACA J Chiropr*. 1973;VII(S-82).
25. Goldstein M. *The research Status of Spinal Manipulative Therapy: A Workshop Held at the National Institutes of Health, February 2-4, 1975*. Vol. 15. Bethesda: U.S. Department of Health, Education, and Welfare; 1975.
26. Walton S. *The Complete Chiropractor: RJ Watkins, DC, PhC, FICC, DACBR*. Asheville, NC: The Institute Chiropractic; 2017.
27. Janse J. History of the development of chiropractic concepts: chiropractic terminology. In: Goldstein M, ed. *The Research Status of Spinal Manipulative Therapy: A Workshop Held at the National Institutes of Health, February 2-4, 1975*. Bethesda, MD: U.S. Department of Health, Education, and Welfare; 1975:25-42.
28. Haldeman S, Hammerich K. The evolution of neurology and the concept of chiropractic. *ACA J Chiropr*. 1973;VII(S-57):60.
29. Watkins RJ. Subluxation terminology since 1746. *J CCA*. 1968 Fourth Quarter. In: Walton S. *The Complete Chiropractor: RJ Watkins, DC, PhC, FICC, DACBR*. Asheville, NC: The Institute Chiropractic; 2017:271-277.
30. Speransky A. *A Basis for the Theory of Medicine*. 2nd ed. New York, NY: International Publishers; 1943.

31. Selye H. *Stress and Disease*. New York, NY: McGraw-Hill; 1956.
32. Korr I. *The Collected Papers of Irvin M. Korr*. American Academy of Osteopathy; 1979.
33. Phillips R. The irritable reflex mechanism. *ACA J Chiropr*. 1975;VIII(S-9).
34. Watkins RJ. Anthropology in reflex technics. *J Natl Chiropr Assoc*. 1948. In: Walton S. *The Complete Chiropractor: RJ Watkins, DC, PhC, FICC, DACBR*. Asheville, NC: The Institute Chiropractic; 2017:761-766.
35. Sato A. The somatosympathetic reflexes: Their physiological clinical significance. In: Goldstein M, ed. *The Research Status of Spinal Manipulative Therapy: A Workshop Held at the National Institutes of Health, February 2-4, 1975*. Bethesda, MD: U.S. Department of Health, Education, and Welfare; 1975:163-172.
36. Gitelman R, Fitz-Ritson D. Somatovisceral reflexes. *ACA J Chiropr*. 1984;18(4):63-64.
37. Kimmel E. Electro analytical instrumentation: Part 2. *ACA J Chiropr*. 1972;VI(S-42).
38. Peterson A, Watkins RJ, Himes H, College CMC. Segmental Neuropathy: *The First Evidence of Developing Pathology*. Online Edition (2nd ed). Available at: <https://www.institutechiro.com/waves/1928-1975/sixth-wave-chiropractic/segmental-neuropathy/>. Accessed September 18, 2018.
39. Keating J. Chronology of Clarence Wolsey Weiant, D.C., Ph.D. Los Angeles College of Chiropractic; 1998.
40. Adelman G. Infrared photography and a new medical device. *Sci Rev Chiropr*. 1964;1(1):31-36.
41. Verner J, Weiant C, Watkins RJ. *Rational Bacteriology*. Peekskill, NY: Weiant; 1953.
42. Kyneur J, Bolton S. Lost technology: the rise and fall of chiropractic instrumentation. *Chiropr Hist*. 1992;12(1):31-35.
43. Weiant C, Adelman G. Photography through the skin proves chiropractic a science. *J Natl Chiropr Assoc*. 1952;20.
44. Rehm W. Necrology. In: *Who's Who in Chiropractic, International*. Dzaman F, ed. Littleton, CO: Who's Who in Chiropractic, International Publishing Co; 1980.
45. Weiant CW, Goldschmidt S. *Medicine and chiropractic*. 2nd ed. New York, NY: Chiropractic Institute; 1966.
46. Forster A. *Principles and practice of chiropractic*. 3rd ed. Chicago, IL: The National Publishing Association; 1923.
47. Illi F. *The Vertebral Column: Life-line of the Body*. Lombard, IL: National College of Chiropractic; 1951.
48. Homewood AE. *The neurodynamics of the vertebral subluxation*. GA: McCoy Press; 2015.
49. Beatty H. *Anatomical Adjustive Technic*; 1939. Denver, CO.
50. Palmer DD. *The science, Art, and Philosophy of Chiropractic*. Portland, OR: Portland Printing House; 1910.
51. Harper W. Clarifying the term "irritation" and its relationship to the chiropractic premise. *J Natl Chiropr Assoc*. 1954;11:9-11.
52. Keating J, William D Harper Jr MS, DC. Anything can cause anything. *J Can Chiropr Assoc*. 2008;52(1):38.
53. Harper WD. The man that chiropractic developed. *Natl Arch*. 1980.
54. Haldeman S. First impressions of the synchro-therme as a skin temperature reading instrument. *J Can Chiropr Assoc*. 1970.
55. Palmer DD. *Letter to B.J. Palmer*; 1902. In: Faulkner T. *The Chiropractor's Protégé: The Untold Story of Oakley G. Smith's Journey with D.D. Palmer in Chiropractic's Founding Years*. Rock Island, IL: Association for the History of Chiropractic; 2017:103.
56. Faulkner T. *The Chiropractor's Protégé: The Untold Story of Oakley G. Smith's Journey with D.D. Palmer in Chiropractic's Founding Years*. Rock Island, IL: Association for the History of Chiropractic; 2017.
57. Keating J. *B.J. of Davenport: The Early Years of Chiropractic*. Davenport, IA: Association for the History of Chiropractic; 1997.
58. De Jarnette B. *Vasomotor control*. Nebraska City, NE: M.B. DeJarnette; 1931.
59. Murdoch C. Measuring heat differentials. *ICA Int Rev Chiropr*. 1964;1(1):24-27.
60. Kyneur J, Bolton S. Chiropractic instrumentation—an update for the '90s. *Chiropr J Aust*. 1991;21(3):82-94.
61. Peters R. *An Early History of Chiropractic: The Palmers and Australia*. Asheville, NC: Integral Altitude; 2014.
62. Duff S. *Chiropractic Clinical Research: Interpretations of Spinal Bilateral Skin Temperature Differentials*. San Francisco, CA: Paragon Printing; 1976.
63. Sherman L. *Neurocalometer, neurocalograph, neurotempometer*. Davenport, IA: Palmer School of Chiropractic; 1966.
64. Miller J. Skin temperature differential analysis. *ICA Int Rev Chiropr*. 1964;1(1):41.
65. Kent C, Daniels J. Chiropractic thermography: a preliminary report. *Int Rev Chiropr*. 1974;7(4):4.
66. Brand NE, Gizoni CM. Moire contourography and infrared thermography: changes resulting from chiropractic adjustments. *J Manipulative Physiol Ther*. 1982;5(3):113-116.
67. Rademacher W. A premise for instrumentation. *Chiropr Tech*. 1994;6(3):84-94.
68. Hayes T, Harper K, Harper A. Chirometer technic. *ICA Int Rev Chiropr*. 1959;8-9, 54-55.
69. Kent C, Gentempo P. Instrumentation and imaging in chiropractic: a centennial retrospective. *Today's Chiropractic*. January/February 1995.
70. Gillet H. The evolution of a chiropractor. *Natl Chiropr J*. 1945:15-19, 54-55.
71. Petersen A. Dr. Andy Peterson talks. In: Beacon P, ed. *Palmer*. Beacon: The Beacon; 1980.
72. Grostic J. The origins of the grostic procedure. *Int Rev Chiropr*. 1978;32:33-35.
73. Amman M. The machines and tools of Dr. Clarence S. Gonstead. *Chiropr Hist*. 2007;27(2):54-58.
74. Cooperstein R, Gleberzon B. *Technique Systems in chiropractic*. Philadelphia, PA: Churchill Livingstone; 2004.
75. Keating J, Edwin H, Kimmel DC, DABCO FICC. FACC: politician, scholar and teacher. *Chiropr Hist*. 2003;23(1):41-71.
76. Becker R, Selden G. *The Body Electric: Electromagnetism and the Foundation of Life*. New York, NY: Quill; 1985.
77. Kaufman D. Exclusive: interview with Dr. Marshall Himes. *Beacon*. 1980(2):1.
78. Kendall H, Kendall F, Wadsworth G. *Muscles Testing and Function*. 2nd ed. Baltimore, MD: Williams and Wilkins; 1971.
79. Palmer BJ. *Clinical controlled chiropractic research*. Vol. 25. Davenport, IA: Palmer School of Chiropractic; 1951.
80. Keating J, Green B, Johnson C. "Research" and "Science" in the first half of the chiropractic century. *J Manipulative Physiol Ther*. 1995;18(6):357-378.
81. Eriksen K, Grostic R. History of the Grostic/orthospinology procedure. In: Eriksen K, Rochester R, Grostic J, eds. *Orthospinology Procedures: An Evidence-Based Approach to Spinal Care*. Philadelphia, PA: Lippincott Williams and Wilkins; 2007.
82. Gregory RR. Aims and objectives of NUCCA: analysis of some unsolved problems in chiropractic. *NUCCA*. 1969:19-26.
83. Rosenthal M. The structural approach to chiropractic: from Willard Carver to present practice. *Chiropr Hist*. 1981;1(1):25-28.

84. Amman M. A profession seeking clinical competency: the role of the Gonstead chiropractic technique. *Chiropr Hist.* 2008;28(2):81-91.
85. Firth J. *Chiropractic Technique Notes: As Compiled From the Lectures of Dr. James N. Firth.* Indianapolis, IN: Lincoln Chiropractic College; 1941.
86. Palmer BJ. *A Textbook on the Palmer Technique of Chiropractic.* Vol. 13. Davenport, IA: Palmer School of Chiropractic; 1920.
87. Fuhr A. *Activator Methods Chiropractic Technique.* St. Louis, MO: Mosby; 1996.
88. Gazette MC. *Dr. Richard Mulcahy is at convention;* 1971.
89. Epstein D. *The mental impulse. Mile High Conference;* 2016.
90. Conable KM, Rosner AL. A narrative review of manual muscle testing and implications for muscle testing research. *J Chiropr Med.* 2011;10(3):157-165.
91. Breig A. *Biomechanics of the Central Nervous System: Some Basic Normal and Pathologic Phenomena.* Stockholm: Almqvist & Wiksell; 1960.
92. Ward LE. *The Spinal Column Stressology Manual of Standard Practices.* Long Beach, CA: SSS Press; 1980.
93. Verner J. *The Science and Logic of Chiropractic.* 8th ed. Brooklyn, NY: Dr. P.J. Cerasoli; 1956.
94. Del Pino M. Questions and comment regarding research of Dr. Hans Selye. *Chiropractor.* 1955;51(2):12.
95. Muller RO. *Autonomics in Chiropractic: The Control of Autonomic Imbalance.* Toronto, Canada: The Chiro Publishing Company; 1954.
96. Palmer BJ. *The Science of Chiropractic: Eleven Physiological.* Vol. 2. Davenport, IA: Palmer School of Chiropractic; 1907.
97. Sterling P, Eyer J. Allostasis: a new paradigm to explain arousal pathology. In: Fisher S, Reason J, eds. *Handbook of Life Stress, Cognition and Health.* New York, NY: John Wiley & Sons; 1988.
98. Goldstein DS, McEwen B. Allostasis, homeostats, and the nature of stress. *Stress Int J Biol Stress.* 2002;5(1):55-58.
99. Ganzel B, Morris P, Wethington E. Allostasis and the human brain: integrating models of stress from the social and life sciences. *Psychol Rev.* 2010;117(1):134.
100. Palmer DD. *The Chiropractor.* Los Angeles, CA: Press of Beacon Light Printing Company; 1914.
101. Heintze A. The proprioceptive faculty: A broader theory of chiropractic is indicated. *Chiropr J.* 1937;11, 44.
102. Janse J. *Principles and Practice of Chiropractic.* Lombard, IL: National College of Chiropractic; 1976.
103. Verner J. *The Science of Chiropractic and Its Proper Place in the New Health Era.* Closter, NJ: Venard Press; 1939.
104. Wright H. Take your choice. *Chiropractor.* 1936;33(11).
105. Lubka B. Prof. A.D. Speransky's research and chiropractic. *Chiropractor.* 1939;35(1):5.
106. Weiant C. Lessons from Speransky: Some specific applications of chiropractic. *J Natl Chiropr J.* 1942;11-12.
107. Selye H. The evolution of the stress concept: The originator of the concept traces its development from the discovery in 1936 of the alarm reaction to modern therapeutic applications of syntoxic and catatoxic hormones. *Am Sci.* 1973;61(6):692-699.
108. Logan H. *Logan Universal Health Basic Technique.* St. Louis, MO: Logan; 1931.
109. De Jarnette B. *Sacro Occipital Technic.* Nebraska City, NE: DeJarnette; 1933.
110. Stonebrink R. Neurological features of the chiropractic philosophy. *J Am Chiropr Assoc.* 1968;2:33-40.
111. Janse J, Houser R, Wells B. *Chiropractic Principles and Technic: For Use by Students and Practitioners.* 2nd ed. Chicago, IL: National College of Chiropractic; 1978.
112. Korr I. *The Neurobiologic Mechanisms in Manipulative Therapy.* Springer Science & Business Media; 1978.
113. Palmer BJ. *Philosophy of Chiropractic.* Vol. 5. Davenport, IA: Palmer School of Chiropractic; 1909.
114. Keating J, Davison R. That down in Dixie school: Texas Chiropractic College, between the wars. *Chiropr Hist.* 1997; 17:17-36.
115. Russell J. Interview with Simon Senzon; 2014.
116. Russell J. Anything can cause anything: A belated tribute to a chiropractic icon—William David Harper, DC, MS, FICC. *Chiropr Hist.* 2008;28(1):49-54.
117. Palmer BJ. *The Philosophy, Science, and Art of Chiropractic Nerve Tracing: A Book of Four Sections.* Vol. 6. Davenport, IA: Palmer School of Chiropractic; 1911.
118. DeJarnette B. *The History of Sacro Occipital Technic.* Nebraska City, NE: DeJarnette; 1958.
119. DeJarnette MB. The chiropractic subluxation. *ACA J Chiropr.* 1965;2(6):8-11.
120. Brown P. Fellow practitioners. *ACA J Chiropr.* 1966;6(3): 17-18.
121. ACA convention report. *ACA J Chiropr.* 1975;12(8):18-21.
122. Howe J. A contemporary perspective on chiropractic and the concept of subluxation. *ACA J Chiropr.* 1976;X (S-165).
123. Haldeman S, Drum D. The compression subluxation. *J Clin Chiropr.* 1971;7:10-21.
124. Wardwell W. *Chiropractic: History and Evolution of a New Profession.* St. Louis, MO: Mosby; 1992.
125. Haldeman S. Discussion: the importance of neurophysiological research into the principles of spinal manipulation. In: Goldstein M, ed. *The Research Status of Spinal Manipulative Therapy: A Workshop Held at the National Institutes of Health, February 2-4, 1975.* Bethesda: U.S. Department of Health, Education, and Welfare; 1975:235-237.



The Chiropractic Vertebral Subluxation Part 8: Terminology, Definitions, and Historicity From 1966 to 1980

Simon A. Senzon, MA, DC

ABSTRACT

Objective: The purpose of this paper is to review and discuss the history of chiropractic vertebral subluxation (CVS) between the years 1966 and 1980, with an emphasis on consensus models and terminology.

Discussion: The consensus models on CVS during this time were an outgrowth of previous model building, research, and practice methods. The first consensus models were developed by the radiology diplomates of the American Chiropractic Board of Radiology. Later work was used to develop Medicare standards. Research and theory were influenced by the 1975 National Institutes of Health conference on spinal manipulation in 1975 and the workshops that followed that meeting. A new historical consciousness about the CVS, developed at the National Institutes of Health conference, which was a turning point for the profession in the use of terminology and the focus on functional pathophysiology associated with CVS. The historical view of CVS developed by Watkins, Haldeman, and Janse led to new integrative and historical developments in the profession.

Conclusion: Theories during this period included consensus efforts as well as new distinctions about CVS theory and terminology. (J Chiropr Humanit 2018;25C:114-129)

Key Indexing Terms: *Chiropractic; History*

INTRODUCTION

The period from 1966 to 1980 in chiropractic was shaped by social, legal, and political pressures, such as the inclusion of chiropractic vertebral subluxation (CVS) in Medicare, federal recognition of the Council on Chiropractic Education, attacks on the chiropractic profession in the United States from the American Medical Association, and the global impact on chiropractic from the New Zealand Royal Commission report.¹⁻³ All of these pressures were involved in a renewed push in the profession to research, validate, and model CVS. Efforts included the first consensus definitions of CVS,⁴⁻⁷ new historical consciousness about CVS,⁸⁻¹⁰ and the conference on Spinal Manipulative Therapy (SMT) hosted by the National Institute of Neurological and Communicative Disorders and Stroke (NINCDS) at the National Institutes of Health (NIH),¹¹ which Taylor et al referred to as “a conference which helped establish chiropractic as a legitimate health care profession worthy of scientific investigation.”¹²

Definitions and discussions of semantics moved into the foreground during this period. Even though CVS theory was at a new height of ubiquity in the profession, especially in terms of the inclusion of complex models of neurophysiology, segments of the profession began to explore new terminology. Joseph Howe’s work provides an example of the changes in terminology at this time. He was a researcher and theorist at the forefront of defining the CVS in the 1960s and 1970s and proposed moving the profession away from the term *subluxation* as the profession’s identity and towards the term *manual therapy*.¹³⁻¹⁶ The purpose of this article is to describe the history of CVS theory during this period and discuss these events.

DISCUSSION

Consensus Definitions (1966-1973)

Three important definitions of CVS were developed between 1966 and 1973. The first was developed by leading radiologists in the profession, the second was at a conference in Houston to address the Medicare law that required subluxation to be diagnosed with x-ray analysis, and the third was a statement developed by the American Chiropractic Association (ACA) Committee on Standardization of Principles, which was started in 1965.

The American College of Chiropractic Roentgenologists formed in 1958.¹⁶ At a meeting in November of 1966, faculty members from x-ray departments of North American

School of Health and Human Sciences, Southern Cross University, Lismore, Australia.

Corresponding author: Simon A. Senzon, MA, DC, 218 E. Chestnut Street, Asheville, NC 28801. Tel.: +1 828 251 0815.

(e-mail: Simon@institutechiro.com).

Paper submitted May 18, 2016; accepted May 15, 2018.
1556-3499

Copyright © 2018 by National University of Health Sciences.
<https://doi.org/10.1016/j.echu.2018.10.006>

Static or Kinetic Disrelationships between Adjacent Articulating Bones
A. Tilt with disc wedging; rotation with disc torque or both.
B. Limitation of some motions with free excursion in others. (Partial fixation)
C. Limitation of all motions. (Total fixation)
D. Normal neutral position but reversed motion in some directions. (Paradoxical)
E. Normal neutral position and normal at ALL extremes but with erratic, jumpy motion between positions. (Usually symptomatic)

Fig 1. Types of chiropractic vertebral subluxation as viewed on x-ray and Cine as described by the American College of Chiropractic Roentgenologists in 1966.

chiropractic colleges met with the members of the American College of Chiropractic Roentgenologists board. At the meeting, slides and movies of spinal dyskinesias were studied and several definitions of CVS were summarized. New subluxation terminology was decided upon.¹⁷ R.J. Watkins published a roentgenological brief, titled “Subluxation Terminology” to explain their consensus.¹⁷ At this meeting, the CVS was viewed as a static or kinetic disrelationship between the articular surfaces based on 4 types: total fixation, partial fixation, the hypermobility CVS, and CVS of a joint (not a bone) at the vertebral motion segment. The definition differentiated CVS into a mechanical element and the neurologic consequences. These were described separately because only the static mechanical element could be viewed with x-ray analysis (Fig 1).

Neurologic consequences were defined as a neuropathy, or a neurologic dysfunction leading to a dystrophy. This definition relied on Speransky’s dystrophic model, which was central to Canadian Memorial Chiropractic College’s (CMCC) textbook, *Segmental Neuropathy*, of which R.J. Watkins was a co-author.¹⁸ The dystrophic process included paresthesias, altered reflexes, and slowed impulse transmission, all of which modified the quality (not quantity) of the nerve impulse. Watkins wrote, “The classic chiropractic definition of a subluxation can be better stated as an

‘intervertebral subluxation with consequent neuropathy.’”¹⁷ This included 3 types of CVS: 1 with neuropathy, 1 with minor muscle imbalance but no neuropathy, and 1 as a consequence of neuropathy, which was thought to lead to a complex chain of neuropathies (Fig 2).⁶ Several detection methodologies were recommended, including x-ray listings. The listings included identification of rotation, lateral tilt, flexion, and extension. In addition, muscle and motion palpation, pressure tests, trial adjustments, and neurologic evaluation were recommended.⁶

In 1972, the American Board of the National Council of Chiropractic Roentgenologists of the ACA held a conference in Houston, Texas. They established a radiologic definition of subluxation for the new Medicare standards. The CVS was defined as, “the alteration of the normal dynamics, anatomical or physiological relationship of contiguous structures.”⁶ The definition followed the American Chiropractic Board of Radiology definition from 1966 and differentiated the mechanical CVS from the neurophysiological effects.⁶

In July 1965, the ACA announced that “five of the most respected educators in the chiropractic profession met at ACA headquarters.”¹⁹ They worked for 5 days to craft a treatise on chiropractic. The announcement said, “No greater nor more important work was ever undertaken. After 70 years of progress, research, and clinical experience, the time has come

3 Combinations of Subluxation
1. Subluxation – minor muscle imbalance with no consequent neuropathy, (These usually clear quickly and easily – no vasodilation failure.).
2. Subluxation with consequent neuropathy (Classic chiropractic specialty.).
3. Subluxation as a symptom of neuropathy (Local or remote.) This type of subluxation as a symptom can initiate further neuropathies to become a complex chain.

Fig 2. Types of chiropractic vertebral subluxation by the American College of Chiropractic Roentgenologists in 1966.

that the basis of chiropractic should be re-evaluated and qualified in the light of present knowledge.”¹⁹ This Committee on Standardization of Chiropractic Principles included Bittner, president of the Chiropractic Institute of New York; Harper, president of Texas Chiropractic College; Homewood, president of CMCC; Janse, president of National Chiropractic College (NCC); and Weiant, dean of Chiropractic Institute of New York. A paper was published in 1973. A 2-paragraph section was titled, “Subluxation—A Clinical Entity.” They wrote:

The mechanical lesion referred to by chiropractors as a subluxation is an attending complication of those mechanical, chemical, and/or psychic environmental irritations of the nervous system, which in the biped man produce muscle contraction sufficient to cause articular dysfunction. Once produced, the lesion becomes a focus of sustained pathological irritation. It irritates proprioceptors in the articular capsules, ligaments, tendons, and muscles of the involved segment. A barrage of impulses streams into the spinal cord, where internuncials receive them and relay them to motor pathways for conduction to muscles and glands, initially in excessive amounts. The contraction, which originated the subluxation is thereby reinforced, thus perpetuating both the subluxation and the pathological process which it engenders.

Not all the irritation originates in the proprioceptors, however. The microtrauma attending the vertebral subluxation sets off an inflammatory reaction with edema, which tends to encroach upon the portion of the spinal nerve contained within the intervertebral foramen; the process may even terminate in foraminal adhesions. Still, more extensive encroachments occur upon the foraminal contents (soft tissues, nerve trunk, and other neural elements) in the presence of developmental defects, congenital anomalies, osseous asymmetries, and degenerative and proliferative changes. With the contributory factor of the subluxation, such complications may trigger a full-fledged syndrome of severe root compression or irritation. The fact that a substantial majority of the spinal nerves pass through movable foramina makes such contingencies by no means rare.⁷

Their theory was consistent with the works of the Palmers,^{20,21} Stephenson,²² Verner,²³ Illi,²⁴ Gillet,²⁵ Homewood,²⁶ Watkins,⁶ and Harper.²⁷

Subluxation Models and Terminology From 1970 to 1977

The models between 1970 and 1977 included information from papers presented at the NINCDS conference and a follow-up workshop in October 1977. Papers were presented at the workshop by Hadleman, Gitelman, Jenness, Korr and other scientists, osteopaths, and medical doctors.²⁸ This period

included the publication of an influential 1975 talk by Howe at NCC and the publication of Janse’s collection of essays.^{15,29}

The NINCDS Conference (1975). The NINCDS conference was recommended by members of the United States Congress because of pressure from the chiropractic profession and politicians who supported chiropractic.³⁰ Two million dollars were allocated through the Department of Health, Education, and Welfare in 1974 for NINCDS to hold the conference known as The Research Status of Spinal Manipulative Therapy. The topic was changed from a conference focusing on chiropractic to a broader focus on SMT. Wardwell, a sociologist who studied the chiropractic profession, wrote, “Switching the focus of the conference from ‘chiropractic’ to ‘spinal and manipulative therapy’ was a stroke of genius.”³⁰ This maneuver opened up invitations to a wider spectrum of researchers, including medical doctors and osteopaths. During his talk, Wardwell coined the acronym “SMT” for spinal manipulative therapy to model the osteopaths’ “OMT” (osteopathic manipulative therapy).^{30,31}

The conference included 58 participants. Eleven chiropractic researchers and educators participated, including Janse, Howe, Gitelman, Drum, Jenness, Haldeman, Kent, and Kleynhans (Fig 3). The conference highlighted several CVS models.¹¹ Researchers included individuals, such as Korr, Denslow, Cyriax, Mennell, Sharpless, Suh, White, and Panjabi.

Murray Goldstein was director of the extramural activities program at NINCDS at the NIH. He chaired the conference and edited the published proceedings. Goldstein offered a word of caution at the start of the *NINCDS Monograph*.¹¹ He



Fig 3. Christopher Kent.

observed that even though chiropractic was largely based on empirical and clinical evidence, such evidence should not get in the way of ethical clinical practice. He cited the Hippocratic Oath, which largely guides medical treatment for things like the common cold, cancer, hypertension, and back pain. The inferential evidence for chiropractic, rather than experimental evidence, did not disqualify the formation of hypotheses. Clinical application is the final arbiter of efficacy.¹¹

Goldstein concluded that “the pathophysiologic role of subluxation as a cause or concomitant of organic disease” was not presented at the conference¹¹ and that the focus was subluxation in relation to back pain. In his NINCDS address, Goldstein did not cite any of the decades of clinical research the chiropractic profession had already engaged in, and so his assessment should be contextualized, especially in terms of the future research trajectory. And yet, within some of the presentations, CVS theories of viscerosomatic reflexes and pathophysiology were described.¹¹

The Pathophysiologic Role of CVS at NINCDS. Haldeman’s paper presented at the conference suggested that the CVS was “not considered a single entity.”³² Haldeman differentiated the term as a skeletal disorder with no reference to symptoms or pathophysiology.³² He then used adjectives to classify them as traumatic, inflammatory, postural, psychosomatic, congenital, primary, secondary, compensatory, and according to the symptom as either asymptomatic, compressional, painful, fixated, hypermobile, or irritable, which included visceral reflex abnormalities. Haldeman described x-ray analysis and clinical procedures, such as palpation and instrumentation, for determining CVS.³²

Other papers at the conference described CVS as “a small fragment of radio-translucent tissue-cartilage” as part of a dynamic motor unit,³³ which causes neurovascular irritation and contributes to patho hemodynamics in relation to skin temperature patterns.^{34,35} French hypothesized that CVS could mechanically compress nerve roots and lead to further exacerbation and visceromotor alteration.³⁶ Sunderland suggested that narrowing of an intervertebral disc leads to CVS and a decreased diameter of the intervertebral foramina encroaching on the nerve.³⁷

Suh noted that the main distinction between a medical subluxation and a chiropractic subluxation is the inclusion of neurophysiological disturbances in the definition. This suggested that CVS had a living character that could not be understood by cadaver models.³⁸

Back Pain Hypothesis. In the context of CVS and back pain Goldstein concludes, “Thus, subluxation remains a hypothesis yet to be evaluated experimentally.”¹¹ His emphasis was that chiropractors should continue to address CVS due to the overwhelming inferential evidence and from there continue to build an experimental database of evidence.

Manipulative Therapy Terminology. The 1975 NIH conference was a turning point for terminology, moving away from the chiropractic profession’s traditional emphasis on abnormal functioning owing to an irritated nervous system and toward

definitions related to the term *SMT*. The conference on spinal and manipulative therapy officially emphasized this terminology and its relation to low back pain¹¹ although it included several papers describing pathophysiological disturbances.^{11,33-38} The conference was also a new meeting ground for an expanded neurologic research model.³⁸

The conference changed the research landscape for chiropractic and the way the profession used its terminology. According to Masarsky and Todres-Masarsky, during the 1960s and 1970s chiropractic was moving away from discussion of CVS in relation to internal disease to better fit in with orthodox medicine.³⁹ They proposed that the NINCDS conference was a turning point when the profession’s focus turned to biomechanical problems, with an emphasis on back pain. According to Vear, this shift was because pain syndromes were easier to document, which made it easier to obtain research grants.⁴⁰

There was a movement to define the profession based on “manipulative therapy,” which may have been inspired by the need to distinguish chiropractic’s role in the new Medicare law and the need to integrate research findings across disciplines.¹⁵ In the follow-up workshop on the neurobiologic basis of SMT, Goldstein writes:

A classical but as yet ‘unproven’ approach to the maintenance of health and the treatment of disease is that described under the broad term manipulation or manipulative therapy. This clinical approach is more than a collection of techniques since it is said to intervene in pathophysiologic processes. Specifically what those processes are and in what ways manipulation might be efficacious remain in the realm of hypothesis. However, fundamental research in neurobiology offers the best promise for the solution of this riddle.²⁸

Howe’s Model (1970-1976). Joseph Howe was a 1952 Palmer School of Chiropractic graduate. In 1959, he became the eighth diplomate of the American Chiropractic Board of Radiology.¹⁶ In 1960, Janse asked Howe to take over teaching post-graduate courses in roentgenology at NCC. Howe taught seminars at Lincoln Chiropractic College and NCC. His main research in the 1960s was conducted at the Associates Diagnostic and Research Center, which became an off-campus residency facility for NCC. Howe helped develop the definition of CVS drafted by the Diplomates of the American Chiropractic Board of Radiology (DACBR) in 1966 and at the Houston Conference in 1972, along with R.J. Watkins.¹⁶ In 1978, Howe became chair of the radiology department at Los Angeles Chiropractic College.¹⁶ In 2016, he was awarded the prestigious Lee-Homewood Heritage Award by the Association for the History of Chiropractic.⁴¹

Howe’s Cineroentgenological Studies of the Spinal Column (1970). With a grant from the ACA and the Foundation for Chiropractic Education and Research, the Associates Diagnostic and Research Center conducted a series of cineroentgenology studies that led to new breakthroughs in the understanding of functional spinal movement. These studies

of 100 patients built upon earlier studies conducted by Higley et al at Lincoln Chiropractic College in the 1960's.^{13,42-44} There was obvious influence of R.J. Watkins' previous theories. For example, Howe included a personal communication with Watkins in his reference list.¹³ He also cites Watkins' paper on upper cervical mechanics because Howe demonstrated the same clinical findings.^{13,45} He writes:

Watkins (26) has described erratic motions and reversal of a movement of the occ/C-1 and C-1/C-2 motor units during flexion. These, we find to be frequent. Sometimes this appears to be a strictly adaptive movement to spare loading from anterior movement of the weight of the head to diseased or malfunctioning lower cervical structures. Other times it appears without apparent problems in the lower neck. This remains a fascinating area which needs much more study. We have observed and recorded dramatic changes in this erratic or reversed motion after adjusting, particularly with proprioceptive reflex techniques.¹³

In 1980, Watkins referred to this as the "reversal subluxation."⁶ This was viewed as a musculoskeletal transducer of dysregulation of local motor control. Howe's tentative summary of findings was that radiographs were inconclusive for malposition, but movement studies demonstrated hypomobility, hypermobility, erratic movement, and reversal motion, even with vertebra that appear aligned (Fig 4). He stressed the importance of motion and muscle palpation. Howe also made a finding that was "considerable"¹³; the dominant motion at the motor unit for lateral flexion is rotation, and "while in rotation – lateral flexion

dominates."¹³ He felt this was an important finding when modifying adjusting methods. Other findings included less motion than expected in lumbar facets, which opposed the literature of the day and that intervertebral motion at the thoracic region is less than it is in other regions of the spine.¹³ Howe concluded that "dysfunction" was a better description of the classic CVS because of the variations of mobility in the lumbar, thoracic, and cervical spines and also that it covers a broader range of conditions.¹³

Howe's Radiological Classification (1975). Howe's paper presented at the NINCDS conference in February 1975 focused on radiological findings.¹⁴ Building on the ACA definition, which emphasized the alteration of normal dynamics and the physiological and anatomic relationships of contiguous articulations, he viewed CVS as a functional derangement. He noted that it is often accompanied by articular pathology. He proposed that CVS may cause abnormal physiological and neuromusculoskeletal responses in body systems.¹⁴ Howe proposed a radiological classification system that included sectional, paravertebral, static, and kinetic intersegmental subluxations (Fig 5).¹⁴ He noted that x-ray analysis was only 1 method of detection, and because of the functional nature of CVS, he suggested that it was not as reliable as other clinical methods.¹⁴

Howe's Linguistic Maneuver to Terminology (1976). In December 1975, Howe expanded his concept of CVS. He delivered a talk at NCC as a part of The Seminar on Chiropractic. He published the talk as a 3-page paper in the *Journal of the ACA*.¹⁵ He set the course for the new way CVS was to be described by much of the profession. His talk was based in part on the Houston conference, which I propose was a reaction to the Medicare inclusion of chiropractic being limited to CVS correction. Howe reasoned that insurance

Howe's Summary of Findings in 1970 (quoted/paraphrased)
1. The cervical region – has many possibilities for articular dysfunction – best viewed with motion studies.
2. Lateral flexion – rotation at the individual motor unit is the dominant motion. Rotation – lateral flexion dominates.
3. Lumbar facet motions are less than expected.
4. Intervertebral motion in the thoracic units appears to be less than in any other spinal area.
5. The intervertebral subluxation is a demonstrable entity in cineroentgenographic studies.
6. Lack of intervertebral motoricity in thoracic and lumbar – makes dysfunction and pathology important. Relative hypermobility of cervical region diminishes the significance of misalignment.
7. Mechanism of sacroiliac motion or lack of – needs further study.

Fig 4. Howe's summary of cineroentgenological studies of the spinal column.

companies will base coverage on the limitations of Medicare and that was unacceptable for the profession. It appeared that the aim of the talk was to minimize the centrality of CVS within chiropractic.¹⁵

Howe built upon the momentum from the NINCDs conference by emphasizing the term *manipulative therapy* as the core of chiropractic, not CVS. He dismissed D.D. Palmer's insights as limited, then described the focus on CVS with terms like "inertia," "inbreeding," and professional "isolation."¹⁵ Howe acknowledged the vast literature from theorists, such as Carver, Janse, Nimmo, B.J. Palmer, Kimmel, Haldeman, Hayes, Homewood, Harper, Levine, Beatty, Mears, and R.J. Watkins.¹⁵ However, rather than explain that they were exploring CVS, he suggested that they were looking at "possible explanations for the effectiveness of manipulative therapy."¹⁵ He did not deny they looked at CVS, but he did not say they did. He appeared to use language to prevent the chiropractic profession from being limited to "correction of subluxation,"¹⁵ as was used in the Medicare definition.

Howe's Definition (1976). Howe acknowledged the historical challenges of the profession and emphasized the need for research. He concluded that CVS is a complex phenomenon rather than a specific entity. He writes:

An anatomically demonstrable articular disrelationship, a physiological articular dysfunction, a neurological aberration from proprioceptive insult secondary to either of these, a noxious neuromuscular reflex, a viscerosomatic or somatovisceral aberration, a psycho-

somatic or somatopsychic phenomenon might all be classified under the large umbrella of subluxation by our definition.¹⁵

Howe suggested that the broadness of this definition should not be the limit of chiropractic.

Janse's Subluxation Model (1976). Joseph Janse had an important role in chiropractic accreditation and professionalization as president of NCC and as an early leader of the Council on Chiropractic Education, which earned him the designation of "the apostle of chiropractic education."⁴⁶ Janse conducted cadaver studies with Illi in the 1940s⁴⁷ and x-ray studies with Fox in 1956,²⁹ in which they described lumbar CVS in greater than two-thirds of the 500 cases with low back pain (Fig 6).²⁹ He published on psychogenic disturbances and reflex CVS.^{48,49} The textbook by Janse et al was reprinted in 1978 (Fig 7), which was based on Forster's text from 1915.^{50,51} In 1976, a collection of Janse's essays were published under the title *J. Janse Principles and Practice of Chiropractic*.²⁹ Some of the essays were from the 1940s and 1950s. Much of the book included chiropractic and physical therapy practice. One chapter was a combination of previously unpublished material along with a 1963 essay called "Chiropractic Concepts and Methods."²⁹

In the chapter titled, "Basic Concepts of Chiropractic Theory,"²⁹ Janse referred to subluxation as a primary form of mechanical distortion and as an orthodysarthric lesion. He proposed that CVS may lead to alteration in the intervertebral foramina, causing pressure, irritation, impingement,

Type	Manifestation
Static intersegmental subluxations	<ol style="list-style-type: none"> 1. Flexion malposition 2. Extension malposition 3. Lateral flexion malposition (right or left) 4. Rotational malposition (right or left) 5. Anterolisthesis (Spondylolisthesis) 6. Retrolisthesis 7. Lateralisthesis 8. Altered interosseous spacing (decreased or increased) 9. Osseous foraminal encroachments
Kinetic intersegmental subluxations	<ol style="list-style-type: none"> 1. Hypomobility (fixation subluxation) 2. Hypermobility (loosened vertebral-motor-unit) 3. Aberrant motion
Sectional subluxations	<ol style="list-style-type: none"> 1. Scoliosis and/or alteration of curves secondary to musculature imbalance 2. Scoliosis and/or alteration of curves secondary to structural asymmetries 3. Decompensation of adaptational curvatures 4. Abnormalities of motion
Paravertebral subluxations	<ol style="list-style-type: none"> 1. Costovertebral and costotransverse disrelationships 2. Sacroiliac subluxations

Fig 5. Howe's radiological classification.

traction of the spinal nerves, and spinosomatic-spinovisceral neurologic syndromes. He acknowledged the strain of ligaments, contracted muscles, and postural and nerve tensions. The main causes of this were listed as gravitation, trauma, defects, and the perpetuation by neurologic disturbance. He also described dozens of aspects of CVS like discomfort, pain, traction, torque, edema, neurologic insult, microscopic ligamentous tears, nerve root pressure, and spinovisceral syndromes. By adding this to his earlier writings on reflex CVS from the 1940s,⁴⁸ I propose that Janse was a CVS theorist.^{29,46,50}

Histories of CVS (1968-1975)

A trend of historicity in CVS emerged during this time. This was apparent in 3 papers: Watkin's *Subluxation*

Terminology Since 1746,⁸ Haldeman and Hammerich's *The Evolution of Neurology and the Concept of Chiropractic*,⁹ and Janse's paper at NINCDS, where he presented a history of chiropractic concepts and terminology.¹⁰ This new approach demonstrated a historical awareness that influenced the next period of CVS theories. Watkins,⁸ Haldeman,⁹ and Janse¹⁰ developed historical perspectives and integrated those with the latest theories and neurologic models.

Watkins' Terminology (1968). R.J Watkins started his history with a definition of subluxation by Hieronymus from 1746, along with other historical definitions, and described D.D. Palmer's concept of CVS as a functional response in the nervous system owing to the structural articular disrelationship. He suggested that if nerves are stretched, impulses are modified because of pressure on the sensory nerves of the

Conclusions	Subluxation findings from 500 cases with low back pain
Female to Male Ratio	<ul style="list-style-type: none"> 50%
General Explanations	<ul style="list-style-type: none"> Most cases were lumbosacral or 5th lumbar involvement Bilateral Sciatic – 2% Unilateral Sciatic – 3% Majority of 500 cases were 5th lumbar with at least one of the following: <ul style="list-style-type: none"> Superior sacral facet rotating into the fifth lumbar foramen due to reverse rotation with sacrum Thinning and compression of disc between the fifth lumbar and sacrum Approximation of the transverse processes of the 5th lumbar against the sacral horns
Interpretation of the findings of subluxation	<ul style="list-style-type: none"> Fifth Lumbar Subluxations: 348 on the anteroposterior views and 307 on the lateral views Fourth Lumbar Subluxations: 369 with evidence on lateral views
Approximation of 5th lumbar to Sacral Horns	<ul style="list-style-type: none"> 323 cases showed some degree either bilateral or unilateral
Sacralization	<ul style="list-style-type: none"> 73 either unilateral or bilateral
Spondylolisthesis or Anterior Displacement	<ul style="list-style-type: none"> 176 showed this line anterior of the promontory of the sacrum
Contracted Psoas	<ul style="list-style-type: none"> 235 unilateral or bilateral
Anterior Gravitational Weight Line	<ul style="list-style-type: none"> 176 showed this line anterior of the promontory of the sacrum
Lumbosacral disc thinning	<ul style="list-style-type: none"> 314 cases of the 5th lumbar and sacral (which is the only one examined)
Weight-bearing and traumatic narrowing and cupping of bodies of vertebrae	<ul style="list-style-type: none"> 278 cases exhibited this pathology
Wrong facet facing	<ul style="list-style-type: none"> 124 showed bilateral or unilateral lumbosacral sagittal facing
Narrowing of the Ischio-trochanteric space	<ul style="list-style-type: none"> 123 portrayed this distortion
Posterior deviation of the pelvis	<ul style="list-style-type: none"> 215 out of 300 cases revealed posterior inclination

Fig 6. Janse's summary of subluxation findings on 500 cases.

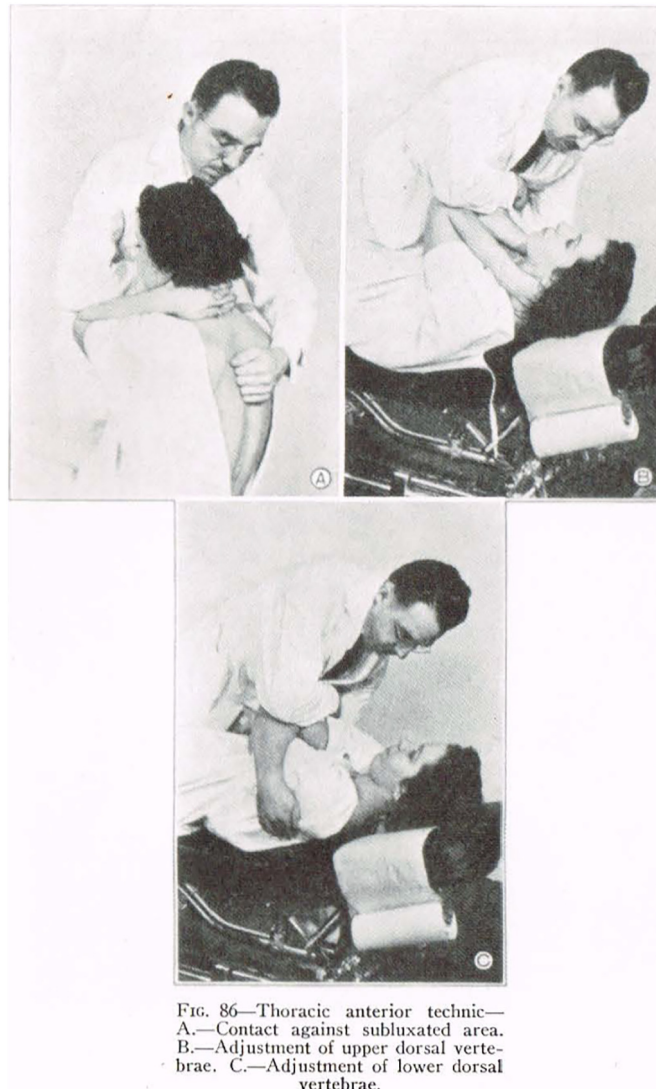


FIG. 86—Thoracic anterior technic—
A.—Contact against subluxated area.
B.—Adjustment of upper dorsal vertebrae. C.—Adjustment of lower dorsal vertebrae.

Fig 7. Janse demonstrating anterior thoracic adjustment in a 1978 reprint of the 1947 textbook.

joint, the afferent cell bodies in the dorsal nerve root ganglia, and, to a lesser extent, on the nerve trunks. Watkins critiqued mistakes he observed in the profession and the overuse of terms like *pinched nerve* and *stepping on a hose*, which were both related to earlier compression theories. He described the highlights of the previous 50 years of chiropractic theory from Smith's ligatite to Gillet's fixation.⁶

According to Watkins, D.D. Palmer's concept that "subluxation of any articulation in the body could initiate a neurologic dysfunction" had fallen into disrepute.⁶ This particular comment was likely aimed at B.J. Palmer's restricted approach to upper cervical subluxation developed in the 1930s. After resigning his position at CMCC in 1968, Watkins ran a cineroentgenology consulting practice owned by Armstrong in Guelph, Ontario.⁶ Reviewing motion studies led him to suggest a new category: the reversal CVS.⁶ He proposed that it was neither fixated nor

malpositioned, but moved erratically because of a disturbance of reciprocal innervation. He concluded that this was due to distortion of the local sensorial conversational tone (Fig 8), which was a concept described in *Segmental Neuropathy*.¹⁸ The input signal of the proprioceptive nerves of the joint becomes a complex "buzz," and the segment becomes "detuned," leading to "fragmentary disintegration." Thus he proposed that no 2 CVSs or their correction were the same.⁶ Watkins used the 1966 terminology developed by the American Council of Roentgenologists.⁶

Haldeman and Hammerich's Evolution of Neurology & Chiropractic (1973). Haldeman and Hammerich's 1973 paper started with a history of research and theory about the nervous system from Aristotle to the nineteenth century.⁹ The paper then set the context for D.D. Palmer's theories in the early twentieth century. They also described an evolution of chiropractic theories about the nervous system and CVS.⁹

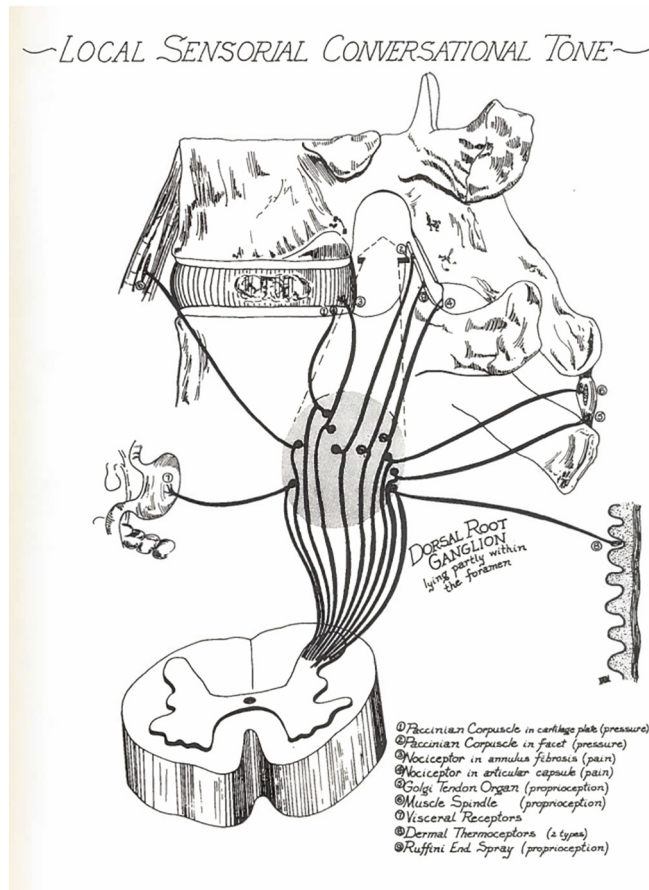


Fig 8. Local sensorial conversational tone from Segmental Neuropathy.

The article captured some of the complexity of chiropractic theory and explored a development of theories apart from the “Palmer Tradition.” These included Janse et al,⁵⁰ Verner,²³ Gillet and Liekens,⁵² Illi,²⁴ Homewood,²⁶ and Harper.²⁷ In citing Janse’s 1947 text, it is possible that they were unaware that the core of the text was from Forster’s 1915 book. In Verner, they found the nonimpinging CVS as the most important concept and a major influence on the Canadian chiropractic models.²³ In their assessment of European researchers, such as Illi and Gillet and Liekens, they suggested that the European’s emphasis on biomechanics and not pathophysiological mechanisms helped them to avoid criticism but offered no real new insight into how chiropractic results were obtained.^{24,52} They concluded that Homewood’s book was objective, but Harper’s book had “gone to extremes in trying to explain the entire function of the body in terms of these reflexes.”^{9,26,27} The article cited Haldeman and Drum’s 1971 paper, which converted the chiropractic concepts of “mental impulse,” “nerve force,” and “nerve pressure” to electro-chemical impulses and blocked axoplasmic flow.⁵³

Noticeably absent from their comprehensive overview was reference to Watkins’ theories or *Segmental Neuropathy*.^{6,18} Considering that Haldeman conducted research for CMCC on the synchro-therme,⁵⁴ in the author’s opinion, it may have been

an oversight, a dismissal, or political. The Food and Drug Administration blocked all transport of the instrument into the United States as part of the American Medical Association’s crackdown on chiropractic in 1968. The profession was silent on the issue.⁵⁵ The International Chiropractic Association (ICA) did nothing to help Peterson,⁵⁵ which led to Himes’ resignation from the association and perhaps CMCC’s distancing from Peterson and the instrument.⁵⁶

Finally, Haldeman and Hammerich wrote of the historical phenomenon of chiropractors who rejected both the chiropractic philosophy and chiropractic practice, many of whom were osteopaths, naturopaths, and homeopaths. They write:

Perhaps the most damaging school of thought which arose among DCs [doctors of chiropractic] at this time was the concept that chiropractic included all forms of therapy which might be helpful to a patient, stopping just short of major surgery and pharmacologic medicine.⁹

They contrasted this approach with the early chiropractic ideas that the adjustment could cure anything. They concluded that this school of thought erroneously defined chiropractic based on doing anything and that both approaches had severe limitations.⁹

Historical Errors in the Haldeman and Hammerich Paper. I propose that there may be several errors in Haldeman and Hammerich's description of the Palmers' early chiropractic theories.⁹ It is not uncommon for papers from this era to contain historical errors because it is only recently that our knowledge about D.D. Palmer's life has increased tenfold.⁵⁷⁻⁶² However, I feel that it is important to point out errors because these papers were influential. For example, Janse may have cited or paraphrased some of these mistakes in his plenary address at the NINCDS conference, which was referenced decades later.^{2,10,30,63-65}

Haldeman and Hammerich stated that D.D. Palmer was educated in the 1860s, which they suggested accounted for his vibrational theory of nerve impulses.⁹ I believe that they were partly right in this assessment. We know that Palmer was primarily self-taught after 1864, when he left Canada and completed his schooling from a "brutish country taskmaster" named John Black.⁶⁶ According to Gaucher-Peslherbe et al, Palmer read the literature dating back 200 years and used the scientific texts of his day, especially anatomy, physiology, and surgery texts.⁶⁷ However, based on the available evidence, D.D. Palmer's studies of physiology and anatomy did not begin until the 1890s, and his vibrational theories were not developed until 1909.⁶⁸⁻⁷²

Haldeman and Hammerich suggested that Stephenson invented the safety pin cycle.⁹ They write, "R. W. Stephenson, who, in 1926, developed the so-called 'safety pin cycle,' which is not very far removed from the concept of the reflex arc." However, it was B.J. Palmer who first proposed the simple cycle in 1907⁷³ and further developed the concept in 1909,⁷⁴ which was later summarized and made popular by Stephenson in 1927.²² It was referred to as the "safety pin cycle" because of B.J. Palmer's original drawing.⁷⁴

Haldeman and Hammerich stated that D.D. Palmer did not engage in specific adjusting and that B.J. Palmer's development of the meric system was not developed from D.D. Palmer's methods. They write:

B.J. Palmer tried to move from the very general techniques of adjusting that his father used to a more specific type of adjustment. He tried to find a specific adjustment, which would be more effective than a generalized thrust. This led to the development of the meric system of adjustment based on the anatomical exit of nerves, which supplied various organs. He then, however, tried to find one spot on the spine, which would be the key to all disease. He settled on the atlas and axis region.⁹

The meric system was developed from D.D. Palmer's original method of nerve tracing, which was his very specific form of assessment tracing tender or inflamed nerves from vertebra to organ or symptom.^{62,75} D.D. Palmer wrote, "The Paris doctors give the back bone a general overhauling, very similar to the Osteopaths, whereas I adjust only one vertebra, making the adjustment direct and specific."²⁰ I suggest that

the meric system was developed by B.J. Palmer and presented in *Volume 4*⁷⁶ as an analysis system and not an adjusting system. B.J. Palmer was not searching for one spot on the spine. It is possible that 1 source of this error may have come from B.J. Palmer's 1961 memoir, which they reference.⁷⁷ B.J. Palmer wrote that book in a teleologic style, as if history was leading to a point of development, one that emphasized his contributions. The development of upper-cervical analysis developed from clinical research. He claimed that he used thermographic instrumentation for about 7 years, starting in 1923, and then determined that "true" subluxations could only occur in the upper cervical spine. This conclusion was based on the hypothesis that the 3 directional movement and the spinal cord tension caused by that movement correlated to the abnormal patterns of thermographic activity.^{78,79} According to B.J. Palmer, this system was an evolution from the meric system but was largely based on his empirical observations using thermography.^{21,80-82}

Haldeman and Hammerich did not mention B.J. Palmer's other contributions to CVS theory, such as the development of his early models of interference and cord pressures,^{73,74} which I consider to be an error of omission. Instead, they focused on his upper cervical approach from the 1930s, which is a more common reference for B.J. Palmer's life and work.

I feel that they overstated their case about the divides within the profession. They referenced the works of Janse and Verner to support their position that the 2 took a more scientific approach to research than Carver from the Carver Chiropractic College and Blodgett from the Universal Chiropractic College. They write:

Those schools of thought that rejected the vitalistic philosophy but retained the spinal adjustment as the basis of chiropractic treatment. These men included J. Janse and J. R. Verner. They were relatively well read in the current textbook knowledge of neurophysiology and accepted most of the current concepts of neurophysiology. They no longer spoke of nerve force or innate intelligence, but still felt that the nervous system was the primary controlling system in the body and any interference with the normal transmission of nervous impulses would result in disease or dysfunction.⁹

They cited Janse's 1947 text, which used the terms *nerve-force* and *central governing intelligence*. Verner's text used "nerve energy" in relation to neurologic interference. Thus, I propose that they mistakenly linked theories from Janse and Verner to nonvitalistic and neurologic approaches and theories from Carver, the Palmers, and their students to vitalistic and nerve force models. Such distinctions were not black and white. Most theorists from this time shared these core hypotheses, and most were exploring the latest neurologic models. For example, Blodgett's predecessor at the Universal Chiropractic College, Joy Loban, authored a text on neurology

that was favorably reviewed in the medical literature.^{83,84} This particular passage could have exacerbated misperceptions about the pervasiveness of the chiropractic paradigm within the profession.

These errors point to the limited historical knowledge about early chiropractic theories during this period. We now have better access to historical documents and more historical literature that has developed since 1975. This access allows us to spot possible errors and speculate on how they may have impacted the discipline of CVS theory. I proposed that these errors impacted the literature.^{2,30,63-65} For example, some were paraphrased in Janse's address at the NINCDS conference and thus published in the proceedings.^{10,11}

Janse's Chiropractic Terminology (1975). Janse's history was delivered at the NINCDS conference. The 8-page paper contained 505 references with a glossary from "A to S," or from "adjustment" to "subluxation."¹⁰ He started his article with the same 2 quotes as Haldeman and Hammerich to capture D.D. Palmer's theories of health as tone and CVS as a cause of tension leading to increased or decreased vibration. Janse equated homeostasis with tone. He concluded that D.D. Palmer's theory of increase or decrease of vibration was a crude explanation of facilitation of inhibition and the role of lowered tissue resistance in relation to disease vulnerability.¹⁰ His paper explored several hypotheses: nerve compression, proprioceptive insult, somatosympathetic reflex, viscerosomatic reflex, somato-somatic reflex, and somatopsychic and neurodystrophic processes.¹⁰

Janse included the development of biomechanical concepts, adjusting concepts, analysis and instrumentation, and adjunctive procedures.¹⁰ He limited the neurodystrophic hypothesis to "the important role of the nervous system in the control of immunogenesis,"¹⁰ rather than general pathophysiology, which was how Speransky coined the term.⁸⁵

This last point is interesting in light of the obituary of Janse, where Phillips and Triano write, "Janse was a major influence in turning the profession away from a monocausal belief in the origin of disease."⁸⁶ Speransky's theory was that a noxious insult to the central nervous system could lead to a wide spectrum of neurodystrophic processes associated with pathophysiology leading to "all the forms of local pathological processes known to us."⁸⁵ Speransky writes:

The dystrophic process arising within the nervous system is capable sometimes of subsiding completely without leaving lasting traces behind it. Sometimes, however, it is preserved in a latent form, and then the application of any new stimulus may call it into life. In the peripheral tissues, there will be a reproduction of the reaction, corresponding in dimensions and form to the process which had already taken place there. We may encounter in this way vascular phenomena (oedema), or inflammatory phenomena (ceratitis), destructions (noma, gangrene, ulcer), new formations (papillomata), that is to say, in the final analysis, *all the*

forms of local pathological processes known to us. Acquaintance with this category of phenomena turns upside down all the old conceptions of the genesis of local pathological processes, shatters a number of the notions created by cellular pathology, and casts doubt on the actual value of classifying diseases according to the organs and systems of the body.⁸⁵

By leaving out the fullness of Speransky's theory and how chiropractors of the past used it as proof of the chiropractic paradigm,^{6,18,23,26,27,81,87,88} I suggest that Janse's interpretation of chiropractic terminology was limited.

NEW PERSPECTIVES, DEFINITIONS, AND COMPLEXES

I propose that the linguistic distinctions in the chiropractic profession between 1966 and 1980 had at least 4 impacts on the profession and the use of subluxation. The first was the expansion of the neuropathic perspective into most CVS theories. The next was the move away from subluxation terminology and towards manipulative terminology. This is highlighted in the proceedings of the NIH conference, the follow-up workshop, Howe's 1975 address to NCC, and the 1979 ICA conference on the principles and practice of chiropractic.^{11,15,28,89} The other impacts include the development of Objective Straight Chiropractic (OSC) by Reggie Gold and the vertebral subluxation complex (VSC) developed by John L. Faye.^{90,91} These distinctions may have helped to reify opposing positions within the profession mostly around diagnosis while further differentiating the CVS terminology.

The Neuropathic Perspective

Central to these approaches was that the CVS was defined across the profession in terms of the articular dysfunction and associated neurologic dysfunctions leading to various abnormal states or neuropathy. In 1966, the DACBRs defined it as, "Intervertebral subluxation with consequent neuropathy."¹⁷

This period was characterized by a neuropathic perspective, which integrated many of the previous theories, including the proprioceptive, reflex, stress, neurodystrophic, biomechanical, and instrumentation influenced models. Ultimately, the concept of the irritated nervous system, reflexively functioning abnormally as a component to articular disrelationships of the spine, goes back to D.D. Palmer.²⁰ Proprioceptive models can be traced to Stephenson and Heintze.^{22,92} Ideas from Heintze and D.D. Palmer influenced Verner, who had a strong impact on this new neuropathic perspective.²³ Haldeman and Hammerich described the importance of Verner's theory of the "non-impinging" CVS.^{9,23} They write:

Verner went to great lengths; to discuss the neurophysiological concepts of his time and felt that cord or nerve root compression could not adequately explain all the results obtained by the chiropractic adjustment. He felt

that the “non-impinging” subluxation was important.... This concept greatly enlarged the chiropractic thinking and influenced especially the Canadian chiropractic concept of disease.⁹

Verner’s influence can thus be extended to many of the definitions of this time period. For example, the Canadian school of thought includes the works of Muller,⁹³ Homewood,²⁶ and CMCC’s *Segmental Neuropathy*¹⁸ in addition to later subluxation theorists, such as Gitelman and Drum.^{35,94} Also, Watkins, who co-authored the second edition of *Rational Bacteriology* with Verner and Weiant,⁹⁵ helped to craft the influential subluxation definition from the DACBR in 1966.^{6,17} The DACBRs distinguished the mechanical element of CVS from the neurologic consequences.^{6,17} The DACBR definition could be viewed as an integration of the neuropathic perspective into the profession’s discourse. They defined neuropathy as:

NEUROPATHY—“Any neurological dysfunction;” earlier dysfunction than the structurally demonstrable “dystrophy.” This term is now used by scientists generally to imply slowing of the speed of impulse transmission PLUS altered reflexes and paresthesias. This is found consistently in diabetes mellitus, rheumatoid arthritis and increasingly in all the degenerative pathologies. Hence the classic chiropractic definition of a subluxation can be better described as an *intervertebral subluxation with a consequent neuropathy*.¹⁷

The height of CVS research from the previous 4 decades was captured in the definition. Several definitions were modeled after this definition, such as the Houston Conference definition,¹⁶ the ACA definition,^{7,96} and later the ICA definition.⁹⁷

Chiropractic Defined by Manipulative Results

Howe’s presentation at NCC further distanced the profession from the terminology of CVS by suggesting that *subluxation* should not define chiropractic, whereas *manipulative results* should. He expanded on the DACBR definition and defined CVS as “not a specific entity but a complex phenomenon,” and he acknowledged the pervasive proof from myriad fields of research, but he did not feel it should define chiropractic. Howe writes:

Chiropractic, and indeed all manipulative art, is defined not by a concept of a lesion or dysfunction it attempts to correct or modify, but by the results it can obtain. Whether or not a subluxation can be depicted radiographically, or whether or not a viable model of subluxation can be produced so that “hard research” can reduce to numbers the mechanisms by which such an entity can cause problems or be corrected, the fact remains that manipulative therapy gets

results in many of man’s ailments. The sine qua non of chiropractic is manipulative results.¹⁵

He continues:

That subluxation exists is documented by many observers: doctors of chiropractic, osteopathy, medicine, and others, each of whom may have a different concept of what it is. That it, in its several manifestations, may have clinical importance is attested by these observers and others. That its correction or at least its modification can have beneficial results cannot be seriously disputed in light of successful treatment of many conditions by manipulators throughout recorded history. The complex phenomenon of subluxation, therefore, must be a part of chiropractic concern and of any scientific investigation of chiropractic.¹⁵

Howe referenced several papers from the medical literature.⁹⁸⁻¹⁰² He then concluded that chiropractors should not be limited in their ability to diagnose any disease process, “or at least be diagnostically competent to recognize those disease processes they should refer for alternate or concurrent therapy.”¹⁵ In this way, he suggested that chiropractic could be integrated into health care with its unique insight that the ability or inability to adapt to the environment should be how chiropractic measures health.

The perspective that chiropractic should be defined by manipulative therapy was carried forward in the 1979 conference by the ICA. In the preface to the textbook that emerged from the conference, Haldeman writes how chiropractic was equated with SMT and that it was the “largest, most skilled, and best-organized body of health care professionals offering this service.”⁸⁹ He defined SMT as:

All procedures whereby the hands are placed on the spine or paraspinal tissues with the object of improving a patient’s health. Such procedures include the specific spinal adjustment, the non-specific long-lever spinal manipulation, mobilization of the joints of the spine, soft tissue massage, trigger-point manipulation, and manual traction.⁸⁹

During this early stage of terminology change in chiropractic, the adjustment of CVS was defined as only a single aspect of a broader therapeutic terminology called SMT. This approach embraced the Middle Chiropractic Paradigm started by John Howard,^{103,104} founder of National School of Chiropractic. This paradigm included many different modalities and methodologies within the definition of chiropractic. In the preface to Howard’s book, he quoted a passage from Yergin’s article in *Nation’s Health* that translated the Greek roots of the word *chiropractic* to “that science of drugless therapy, which is accompanied by skillful hand treatments.”¹⁰⁴ From this perspective, adjustment of CVS was viewed as essential, but chiropractic also included “every form of hand

treatment requiring scientific and skillful hand application.”¹⁰⁴ This may not have been how D.D. Palmer originally intended this word to be used,²⁰ which opens up a discussion about this modern approach. I suggest that the modern use of the term SMT developed from the need to research and dialogue with other disciplines and scientists and to be inclusive so that insurance reimbursement would not be limited to the Medicare restrictions to CVS.^{11,15,28,89}

Chiropractic Defined by Objective

It is likely that the OSC movement was partly a reaction to the linguistic move away from CVS as the defining characteristic of the profession.^{2,91,105} The movement was centered at Sherman College of Chiropractic. This movement contributed to the development of an alternative accrediting agency for several schools that were solely focused on the analysis and correction of the CVS.¹⁰⁶ Their position was to make CVS the only diagnosis required for chiropractors.^{1,2,107}

The OSC differentiation could be viewed in the same spirit as the DACBR definition. However, this caused an additional split of the CVS into 3 aspects: anatomic, neurologic, and philosophical. The philosophical aspects related to the body's inherent ability to self-organize and self-heal.¹⁰⁸ We might view this as 3 levels of complexity: the anatomic, the neurologic, and the functional organizational levels.

The straight movement did not dismiss the core chiropractic models like the mental impulse.¹⁰⁸ This was different than Haldeman and Drum's conversion of philosophical terms, like nerve force, nerve pressure, and mental impulse, into physiological and chemical reactions and Janse's equation of tone to homeostasis.^{10,53} From the OSC perspective, mental impulse was viewed as analogous to the organizing information conveyed by the nerve and innate intelligence was viewed along the lines of R.W. Stephenson's biological-level definition as the law of organization in living systems.^{22,108,109}

The OSC approach emphasized the mechanical and the neurophysiological elements while further differentiating the CVS from its philosophical roots. They defined innate intelligence by the organization of biological processes and not by the psychospiritual definitions traditionally attributed to it by the Palmers.^{20,108,110} Psychospiritual definitions of Innate were downplayed to focus on the physiological importance of detecting and correcting CVS.⁹¹ From this period forward, CVS could be described in 3 broad categories: mechanically, neurologically, and organizationally.

The Vertebral Subluxation Complex. Leonard J. Faye developed the VSC model in 1967 to teach at Anglo-European Chiropractic College. The VSC model was comprised of 5 components: biomechanical, neurologic, muscular, inflammatory, and the stress response. Faye was inspired to make these differentiations after reading an ACA sponsored article in the 1960s.¹¹¹ This may have been the DACBR definition or an early report of the new ACA

definition. It is possible that Faye, who graduated from CMCC in 1960, was inspired by Homewood, who was president during this time.^{112,113} In his 1962 book, Homewood writes of the CVS in terms of “biochemical, biomechanical, pathophysiological, radiological, subjective, and objective symptoms.”²⁶ Homewood's book may have inspired the DACBR definition as well. After Faye published his course notes in 1983, several developments of his models were integrated into the profession.¹¹⁴⁻¹¹⁶ Faye's subluxation complex became one of the most influential contributions to the subluxation literature after 1980.

By 1980, Harper had died, the Association for the History of Chiropractic was formed, and several new journals emerged that would shape the theoretical and empirical discourse. The *Journal of Manipulative and Physiological Therapeutics* was already 2 years old.² In 1980, important books were published: Haldeman's *Modern Developments in the Principles and Practice of Chiropractic*,⁸⁹ Leach's *Chiropractic Theories*,¹¹⁷ and the second edition of *Who's Who in Chiropractic International*, which included Rehm's *Necrology* and Gibbon's history of chiropractic education.¹¹³ Gibbons and Rehm helped to form the journal *Chiropractic History*, which started in 1981 and fostered the new historical consciousness in the profession.²

Limitations

This paper is based upon a single author's interpretation of the evidence available. Future reviews of the literature should include more systematic methods. Because of the difficulties in obtaining primary sources for this type of research, it is possible that this work is missing some important source documents. It is hoped that future researchers will help to fill in gaps in this literature.

CONCLUSIONS

The time between 1966 and 1980 was pivotal for the development of CVS theory. Consensus models and landmark conferences laid the foundation for the profession. Theory would go into the following 2 primary directions after this time: (1) more profession-wide consensus and model building based on research and the literature, and (2) more attempts to distance the profession from CVS terminology. In 1977, at the close of his talk at the NIH workshop on the neurobiologic mechanisms of manual therapy, Haldeman cautioned theorists and scientists that they should have an open dialog to ensure that their theories were plausible.²⁸ This was not a substitute for empirical research, but it was a valid method of developing theory and one that has been used in the profession throughout its history. Integration of previous theory, reviewing potential historical errors, and clarifying the history of definitions during this time allows new insights to emerge to interpret the literature.

ACKNOWLEDGMENTS

The author acknowledges Brian McAulay, DC, PhD, David Russell, DC, Stevan Walton, DC, and the Tom and Mae Bahan Library at Sherman College of Chiropractic for their assistance.

FUNDING SOURCES AND CONFLICTS OF INTEREST

The author received funding from the Association for Reorganizational Healing Practice and the International Chiropractic Pediatric Association for writing this series of papers. No conflicts of interest were reported for this study.

CONTRIBUTORSHIP INFORMATION

Concept development (provided idea for the research): S.A.S.
Design (planned the methods to generate the results): S.A.S.
Supervision (provided oversight, responsible for organization and implementation, writing of the manuscript): S.A.S.

Data collection/processing (responsible for experiments, patient management, organization, or reporting data): S.A.S.
Analysis/interpretation (responsible for statistical analysis, evaluation, and presentation of the results): S.A.S.

Literature search (performed the literature search): S.A.S.
Writing (responsible for writing a substantive part of the manuscript): S.A.S.

Critical review (revised manuscript for intellectual content, this does not relate to spelling and grammar checking): S.A.S.

Practical Applications

- This series of articles provides an interpretation of the history and development of chiropractic vertebral subluxation theories.
- This series aims to assist modern chiropractors to interpret the literature and develop new research plans.

REFERENCES

1. Rutherford L. *The Role of Chiropractic*. Health Education Pub. Corp: Eugene, OR; 1989.
2. Keating J, Callender A, Cleveland CA. *History of Chiropractic Education in North America*. Association for the History of Chiropractic: Davenport, IA; 1998.
3. *Chiropractic in New Zealand. Report of the Commission of Inquiry*. Wellington, N.Z.: Govt. Printer; 1979.
4. Gatterman M. *Foundations of Chiropractic Subluxation*. 2nd ed. St. Louis, MO: Mosby; 2005.
5. The ACC Chiropractic Paradigm. Available at: <http://www.chirocolleges.org/resources/chiropractic-paradigm-scope-practice/>. Accessed December 3, 2018.
6. Walton S. *The Complete Chiropractor: RJ Watkins, DC, PhC, FICC, DACBR*. Asheville, NC: The Institute Chiropractic; 2017.
7. Bittner H, Harper W, Homewood A, Janse J, Weiant C. Chiropractic of today. *The ACA Journal of Chiropractic*. 1973; VII:S-82.
8. Watkins RJ. Subluxation terminology since 1746. *J CCA*. Fall 1968. In: Walton S. *The Complete Chiropractor: RJ Watkins, DC, PhC, FICC, DACBR*. Asheville, NC: The Institute Chiropractic; 2017:271-279.
9. Haldeman S, Hammerich K. The evolution of neurology and the concept of chiropractic. *ACA Journal of Chiropractic*. 1973;VII (S-57):60.
10. Janse J. History of the development of chiropractic concepts: chiropractic terminology. In: Goldstein M, ed. *The Research Status of Spinal Manipulative Therapy: A Workshop Held at the National Institutes of Health, February 2-4, 1975*, Vol. 15. Bethesda, MD: U.S. Department of Health, Education, and Welfare; 1975:25-42.
11. Goldstein M. *The Research Status of Spinal Manipulative Therapy: A Workshop Held at the National Institutes of Health, February 2-4, 1975*, Vol 15. Bethesda, MD: U.S. Department of Health, Education, and Welfare; 1975.
12. Taylor J, Yochum T, Joseph W. Howe: a pioneer in the evolution of chiropractic radiology. *Chiropr Hist*. 1993;13(1):35-39.
13. Howe J. Preliminary observations from cinerentgenological studies of the spinal column. *The ACA Journal of Chiropractic*. 1970;IV:S-65.
14. Howe J. The role of x-ray findings in structural diagnosis. In: Goldstein M, ed. *The Research Status of Spinal Manipulative Therapy: A Workshop Held at the National Institutes of Health, February 2-4, 1975*, Vol 15. Bethesda, MD: U.S. Department of Health, Education, and Welfare; 1975:239-247.
15. Howe J. A contemporary perspective on chiropractic and the concept of subluxation. *The ACA Journal of Chiropractic*. 1976; X:S-165.
16. Young K, Joseph W, Howe DC. D.A.C.B.R., and the development of modern chiropractic radiology. *Chiropr Hist*. 1999;19(2):27-47.
17. Watkins RJ. Subluxation terminology. *J Am Chiropr Assoc*. September 1968. In: Walton S. *The Complete Chiropractor: RJ Watkins, DC, PhC, FICC, DACBR*. Asheville, NC: The Institute Chiropractic; 2017:341-342.
18. Peterson A, Watkins RJ, Himes H, College CMC. *Segmental Neuropathy: The First Evidence of Developing Pathology*. North York, ON: Canadian Memorial Chiropractic College; 1965.
19. Committee on Standardization of Chiropractic Principles. *The ACA Journal of Chiropractic*. July 1965:27.
20. Palmer DD. *The Science, Art, and Philosophy of Chiropractic*. Portland, OR: Portland Printing House; 1910.
21. Palmer BJ. *History in the Making*, Vol. 35. Davenport, IA: Palmer College; 1957.
22. Stephenson R. *Chiropractic Textbook*, Vol. 14. Davenport, IA: Palmer School of Chiropractic; 1927.
23. Verner J. *The Science and Logic of Chiropractic*. 8th ed. Dr. P.J. Cerasoli: Brooklyn, NY; 1956.
24. Illi F. *The Vertebral Column: Life-Line of the Body*. Lombard, IL: National College of Chiropractic; 1951.
25. Gillet H. The evolution of a chiropractor. *The National Chiropractic Journal*. November 1945:15-19, 54-55.
26. Homewood AE. *The Neurodynamics of the Vertebral Subluxation*. 3rd ed. Homewood; 1981.

27. Harper W. *Anything Can Cause Anything: A Correlation of Dr. Daniel David Palmer's Principles of Chiropractic*. Pasadena, TX: William D. Harper; 1964.
28. Korr IM. *The Neurobiologic Mechanisms in Manipulative Therapy*. New York, NY: Plenum Press; 1977.
29. Janse J. *Principles and Practice of Chiropractic*. Lombard, IL: National College of Chiropractic; 1976.
30. Wardwell W. *Chiropractic: History and Evolution of a New Profession*. St. Louis, MO: Mosby; 1992.
31. Wardwell W. Discussion: The impact of spinal manipulative therapy on the health care system. *Paper presented at: The Research Status of Spinal Manipulative Therapy—A Workshop Held at the National Institute of Health*, February 2-4; 1975. Bethesda, MD.
32. Haldeman S. Discussion: The importance of neurophysiological research into the principles of spinal manipulation. In: Goldstein M, ed. *The Research Status of Spinal Manipulative Therapy: A Workshop Held at the National Institutes of Health, February 2-4, 1975*, Vol 15. Bethesda, MD: U.S. Department of Health, Education, and Welfare; 1975:235-237.
33. Cyriax J. Treatment of pain by manipulation. In: Goldstein M, ed. *The Research Status of Spinal Manipulative Therapy: A Workshop Held at the National Institutes of Health, February 2-4, 1975*, Vol 15. Bethesda, MD: U.S. Department of Health, Education, and Welfare; 1975:271-274.
34. Jenness M. The role of thermography and postural measurement in structural diagnosis. In: Goldstein M, ed. *The Research Status of Spinal Manipulative Therapy: A Workshop Held at the National Institutes of Health, February 2-4, 1975*, Vol 15. Bethesda, MD: U.S. Department of Health, Education, and Welfare; 1975:255-263.
35. Drum D. The vertebral motor unit and intervertebral foramen. In: Goldstein M, ed. *The Research Status of Spinal Manipulative Therapy: A Workshop Held at the National Institutes of Health, February 2-4, 1975*, Vol 15. Bethesda, MD: U.S. Department of Health, Education, and Welfare; 1975:63-75.
36. French L. Discussion: Papers of J.S. Denslow and Scott Haldeman. In: Goldstein M, ed. *The Research Status of Spinal Manipulative Therapy: A Workshop Held at the National Institutes of Health, February 2-4, 1975*, Vol 15. Bethesda, MD: U.S. Department of Health, Education, and Welfare; 1975:235-237.
37. Sunderland S. Anatomical perivertebral influences on the intervertebral foramen. In: Goldstein M, ed. *The Research Status of Spinal Manipulative Therapy: A Workshop Held at the National Institutes of Health, February 2-4, 1975*, Vol 15. Bethesda, MD: U.S. Department of Health, Education, and Welfare; 1975:129-140.
38. Suh CH. Biomechanical aspects of subluxation. In: Goldstein M, ed. *The Research Status of Spinal Manipulative Therapy: A Workshop Held at the National Institutes of Health, February 2-4, 1975*, Vol 15. Bethesda, MD: U.S. Department of Health, Education, and Welfare; 1975:103-118.
39. Masarsky C, Todres-Masarsky M. *Somatovisceral Aspects of Chiropractic: An Evidence-Based Approach*. New York, NY: Churchill Livingstone; 2001.
40. Vear H. Neurological fitness interview. *Neuro Fit*. 1997;7(1):4.
41. Association for the History of Chiropractic. Awards and honors: Lee-Homewood heritage award. Available at: <http://www.historyofchiropractic.org/awards-and-honors/>. Accessed: September 19.
42. Higley H, Rich E, Goodrich T. *Lumbo-sacral Spine Facet Facings*. Los Angeles, CA: Foundation for Chiropractic Education and Research; 1967.
43. Higley H, Rich E, Goodrich T. Report of a study of spinal mechanics L-3, L-4, L-5. Los Angeles, CA: Foundation for Chiropractic Education and Research; 1968.
44. Rich E. Cineroentgenological observations of the human system. *Scientific Yearly of Lincoln Chiropractic College*. 1966;1:109.
45. Watkins RJ. Upper cervical mechanics. *J Clin Chiropr*. 1969;2(2). In: Walton S. *The Complete Chiropractor: RJ Watkins, DC, PhC, FICC, DACBR*. Asheville, NC: The Institute Chiropractic; 2017:137-143.
46. Phillips R. *Joseph Janse: The Apostle of Chiropractic Education*. Los Angeles, CA: R. Phillips; June 2006:53-56.
47. Baker J, Fred WH, Illi DC. (1901-1981): A clinical reformation in chiropractic. *J Am Chiropr Assoc*. 1997.
48. Janse J. Study of reflex and pressure technics. *National Chiro J*. 1946;XVI:9-10.
49. Janse J. Nerve reactions: causes of psycho-neurosis are outlined. *National College Journal of Chiropractic*; February 1942:25-27.
50. Janse J, Houser RH, Wells BF. *Chiropractic Principles and Technic: For Use by Students and Practitioners*. 2nd ed. Chicago, IL: National College of Chiropractic; 1978.
51. Forster A. *Principles and Practice of Spinal Adjustment*. Chicago, IL: The National School of Chiropractic; 1915.
52. Gillet H, Liekens M. *Belgium Chiropractic Research Notes*. 8th ed.; 1970. Brussels, Belgium.
53. Haldeman S, Drum D. The compression subluxation. *J Clin Chiropr*. 1971;1:10-21.
54. Haldeman S. First impressions of the synchro-therme as a skin temperature reading instrument. *J Can Chiropr Assoc*. April 1970:7-8.
55. Petersen A. Dr. Andy Peterson talks. In: Beacon P, ed. *Palmer Beacon: The Beacon*; July-August 1980.
56. Himes H, SHayes S. Letter. *Hayes Collection*; 1964.
57. Waters T. *Chasing D.D.: D.D. Palmer in the News 1886-1913*. Raleigh, NC: Lulu, Inc.; 2013.
58. Waters T. *Fishing for Palmer in What Cheer: D.D. Palmer 1882-1886*. Raleigh, NC: Lulu, Inc.; 2015.
59. Faulkner T, Foley J. The science, art, and philosophy of chiropractic by D.D. Palmer: identification and rarity of editions in print with a survey of original copies. *Chiropr Hist*. 2015;35(1): 36-45.
60. Foley J. The chiropractor 1914: Revealed. *Chiropr Hist*. 2016;36 (1):72-86.
61. Bovine GDD. Palmer's adjustive technique for the posterior apical prominence: "Hit the High Places". *Chiropr Hist*. 2014;34 (1):7-19.
62. Faulkner T. *The Chiropractor's Protégé: The Untold Story of Oakley G. Smith's Journey with D.D. Palmer in Chiropractic's Founding Years*. Rock Island, IL: Association for the History of Chiropractic; 2017.
63. Moore S. *Chiropractic in America: The History of a Medical Alternative*. Baltimore, MD: Johns Hopkins University Press; 1993.
64. Meeker W, Haldeman S. Chiropractic: A profession at the crossroads of mainstream and alternative medicine. *Ann Intern Med*. 2002;136:216-217.
65. Kaptchuk TJ, Eisenberg DM. Chiropractic: origins, controversies, and contributions. *Archives of Internal Medicine*. 1998;158(20): 2215-2224.
66. Waters T. *Chips From Sweet Home: Writings of D.D. Palmer 1869-1881*. Raleigh, NC: Lulu, Inc.; 2013.
67. Gaucher-Peslherbe P, Wiese G, Donahue J. Daniel David Palmer's medical library: The founder was "into the literature". *Chiropr Hist*. 1995;15(2):63-69.
68. Palmer DD. Foreword. *The Chiropractor Adjuster*, 1909;1(2):29.
69. Palmer DD. Letter to W.J. Steckel. Joseph M. Foley Archives; 1892.

70. Palmer DD. The Magnetic Cure; 1896.
71. Palmer DD. The Chiropractic, 17; 1897.
72. Palmer DD. The Chiropractic; 1899(26).
73. Palmer BJ. *The Science of Chiropractic: Eleven Physiological*, Vol. 2. Davenport, IA: Palmer School of Chiropractic; 1907.
74. Palmer BJ. *Philosophy of Chiropractic*, Vol. 5. Palmer School of Chiropractic; Davenport, IA; 1909.
75. Palmer DD, Palmer BJ. *The Science of Chiropractic*. Davenport, Iowa: The Palmer School of Chiropractic; 1906.
76. Palmer BJ. *The Science of Chiropractic: Causes Localized*, Vol. 4. Davenport, IA: Palmer School of Chiropractic; 1908.
77. Palmer BJ. *Our Masterpiece*, Vol. 39. Davenport, IA: Palmer College; 1966.
78. Palmer BJ. Hole-in-one theory absolutely right. *Fountainhead News*. 1930;18:3.
79. Craven JH. Interference. *The Chiropractor*. 1925;21(12):35, 43.
80. Palmer BJ. *The Subluxation Specific The Adjustment Specific*, Vol. 18. Davenport, IA: Palmer School of Chiropractic; 1934.
81. Palmer BJ. *Precise, Posture-Constant, Spinograph, Comparative Graphs*, Vol. 20. Davenport, IA: Palmer School of Chiropractic; 1938.
82. Palmer BJ. *Clinical Controlled Chiropractic Research*, Vol. 25. Davenport, IA: Palmer School of Chiropractic; 1951.
83. Loban J. *A Textbook of Neurology: Arranged for the Classroom and for Ready Reference by the Practitioner*. Denver, CO: Bunn-Loban Publishing Company; 1929.
84. Book Reviews: Loban, Joy M. A textbook of neurology. *J Nervous Mental Disease*. 1931;73(4):453.
85. Speransky A. In: Dutt C, ed. A basis for the theory of medicine. New York, NY: Inter-national Publishers; 1936.
86. Phillips R, Triano JJ. Historical perspective Joseph Janse. *Spine*. 1995;20(21):2349-2353.
87. Weiant C. Lessons from Speransky: Some specific applications of chiropractic. *Journal of National Chiropractic Journal*. December 1942:11-12.
88. Lubka B. Prof. A.D. Speransky's research and chiropractic. *The Chiropractor*. 1939;35(1):5.
89. Haldeman S. *Modern Developments in the Principles and Practice of Chiropractic*. New York, NY: Appleton-Century-Crofts; 1980.
90. Faye JL. *Motion Palpation of the Spine*. Huntington Beach, CA: Motion Palpation Institute; 1983.
91. Strauss J. *Refined by Fire: The Evolution of Straight Chiropractic*. Levittown, PA: Foundation for the Advancement of Chiropractic Education; 1994.
92. Heintze A. The proprioceptive faculty: a broader theory of chiropractic is indicated. *Chiropr J*. February 1937;11, 44.
93. Muller RO. *Autonomics in Chiropractic: The Control of Autonomic Imbalance*. Toronto, Canada: The Chiro Publishing Company; 1954.
94. Gitelman R, Fitz-Ritson D. Somatovisceral reflexes. *ACA J Chiropr*. 1984;18(4):63-64.
95. Verner J, Weiant C, Watkins RJ. *Rational Bacteriology*. Peekskill, NY: Weiant; 1953.
96. Luedtke K. Chiropractic definition goes to World Organization. *J Am Chiropr Assoc*. 1988;25:6.
97. *International Chiropractor's Association Definition of Subluxation*. Washington, DC: ICA; 1987.
98. Kunert W. Functional disorders of internal organs due to vertebral lesions. Paper presented at: Ciba Symposium. 1965;13(3):85-96.
99. Dandy D, Shannon M. Lumbosacral subluxation. *J Bone Jt Surg*. 1971;53-B(4):578.
100. Dankmeijer J, Rethmeier B. The lateral movement in the atlanto-axial joints and its clinical significance. *Acta Radiologica*. 1943; 24(1):55-66.
101. Bailey H, Beckwith C. Short leg and spinal anomalies: their incidence and effects on spinal mechanics. *J Am Osteopath Assoc*. 1937;36:319-327.
102. Larson N. Sacroiliac and postural changes from anatomic short lower extremity. *J Am Osteopath Assoc*. 1940;40:88-89.
103. Senzon S. Chiropractic and systems science. *Chiropr Dialogues*. December 25, 2015:9-20.
104. Howard J. *Encyclopedia of Chiropractic (The Howard System)*. Chicago, IL: National School of Chiropractic; 1912.
105. Senzon S. Chiropractic professionalism and accreditation: an exploration of conflicting worldviews through the lens of developmental structuralism. *J Chiropr Hum*. 2014;21(1):25-48.
106. Hudgens A. A contrast: Educational standards of CCE and the Commission on Accreditation of SCASA. *J Straight Chiropr*. 1980;1:61-72.
107. Hidde O. Do chiropractors treat disease? *Digest Chiropr Economics*. July/August 1979:80-81.
108. Senzon S. Causation related to self-organization and health related quality of life expression based on the vertebral subluxation model, the philosophy of chiropractic, and the new biology. *J Vertebral Subluxation Res*. 1999;3: 104-112.
109. Koch D. *Contemporary Chiropractic Philosophy: An Introduction*. Marietta, GA: Roswell (Life University Press); 2008.
110. Palmer BJ. *The Bigness of the Fellow Within*, Vol. 22. Davenport, IA: Palmer College; 1949.
111. Faye LJ. The subluxation complex. *J Chiropr Humanit*. 1999;9 (1):1-4.
112. Faye LJL. *John Faye articles: 1996-1999*. Dynamic Chiropractic; 1999.
113. Rehm W. Who's who in chiropractic. *Necrology*. In: Dzaman F, ed. *Who's Who in Chiropractic, International*. Littleton, CO: Who's Who in Chiropractic, International Publishing Co; 1980.
114. Lantz C. The vertebral subluxation complex: Part 1. *Chiropr Research J*. 1989;1:3.
115. Dishman R. Review of the literature supporting a scientific basis for the chiropractic subluxation complex. *J Man and Phys Ther*. 1985;8(3):163-174.
116. Gatterman M. *Foundations of Chiropractic Subluxation*. St. Louis, MO: Mosby; 1995.
117. Leach R. *The Chiropractic Theories: A Synopsis of Scientific Reaserch*. Mississippi State, MS: Mid-South Scientific Publishers; 1980.



The Chiropractic Vertebral Subluxation

Part 9: Complexes, Models, and Consensus

From 1979 to 1995

Simon A. Senzon, MA, DC

ABSTRACT

Objective: The purpose of this paper is to review and discuss the history of chiropractic vertebral subluxation (CVS) between 1979 and 1995, with an emphasis on complexes, models, and consensus.

Discussion: New models were developed and critiqued during this period. The first subluxation complex model was proposed by Faye. Other theorists such as Lantz and Dishman built upon his model. The complex models were integrated into consensus statements by the International Chiropractic Association and the American Chiropractic Association, and later by profession-wide processes. The plurality of the CVS encompassed known theories and included integration of stress models and biochemistry. The professional consensus around CVS was comprehensive as shown by the process models that included stakeholders in the profession. Calls for more empirical research and changes to terminology increased during this era. Influential articles from this period potentially contained errors and relied on older studies that may no longer be valid.

Conclusion: The challenges to researching this complex entity during that time were daunting for many and pointed to challenges of using the word “subluxation” to encompass the multiplicity that defined CVS. (*J Chiropr Humanit* 2018;25C:130-145)

Key Indexing Terms: *Chiropractic; History*

INTRODUCTION

Between 1979 and 1995, chiropractic vertebral subluxation (CVS) theories developed greater complexity and new theoretical models and were defined by several significant consensus statements, even while the terminology continued to be critiqued. In 1983, Leonard J. Faye published *Motion Palpation of the Spine*, which described the subluxation complex (SC) for the first time.¹ Other authors updated his model, such as Dishman’s chiropractic subluxation complex (CSC)² and Lantz’s vertebral subluxation complex (VSC).^{3,4} New models were developed during this period. Examples include Barge’s models⁵⁻⁹; Gitelman’s models¹⁰; Reinert’s cervical, lumbar, and sacral models¹¹⁻¹³; J. D. Grostic’s dentate ligament hypothesis¹⁴; and Gatterman’s extension of the fixation model to focus on pain.¹⁵

In the late 1980s, the American Chiropractic Association (ACA) and the International Chiropractic Association (ICA) developed separate CVS definitions.^{16,17} In the

early 1990s, Gatterman organized a conference around terminology at Canadian Memorial Chiropractic College (CMCC).¹⁸ By 1993, the consensus processes expanded to include stakeholders from chiropractic schools and organizations using consensus group processes, which led to several different definitions as well as textbooks.^{19,20}

The purpose of this article is to describe contributions to CVS theory, integrative approaches, and the CVS viewed as a complex. The discussion examines limitations of the critical literature, commonalities of models, and new perspectives. This paper contrasts some of the arguments about validity, which originated during this period, with recent approaches to CVS research.

DISCUSSION

CVS Models (1979-1995)

Four novel contributions to CVS theory emerged between 1981 and 1995. These models follow “lineages” that build upon previous theories. These theoretical lines include the Palmer line, the Loban line, the Gregory line, and the Canadian line (Fig 1).

Barge’s Model. Fred Barge graduated from the Palmer School of Chiropractic (PSC) in 1954 and completed 9 months of postgraduate studies in technic at Logan Chiropractic College (Logan) in 1955. He interned with Clarence Gonstead in the Gonstead Clinic at Mount Horeb.

School of Health and Human Sciences, Southern Cross University, Lismore, New South Wales, Australia.

Corresponding author: Simon A. Senzon, MA, DC, 218 E Chestnut Street, Asheville, NC 28801. Tel.: +1 828 251 0815.

(e-mail: Simon@institutechiro.com).

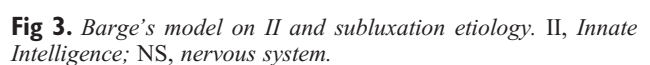
Paper submitted May 18, 2016; accepted May 15, 2018.
1556-3499

Copyright © 2018 by National University of Health Sciences.

<https://doi.org/10.1016/j.echu.2018.10.007>



In his 1990 book, *One Cause, One Cure*, Barge expanded on several important ideas related to CVS, such as its role as a primary cause of “tension,” leading to “aberration of internal functions,” setting the stage for “the



Components of Subluxation	Abnormalities	Leads to
Hypermobility	<ul style="list-style-type: none"> • Failure of ligaments to restrain joint • ROM beyond natural limits • Altered structural attitude at the extremes of motion 	<ul style="list-style-type: none"> • Neurological and circulatory disturbances • Encroachment on adjacent tissues
Hypomobility	<ul style="list-style-type: none"> • Fixation of joint • Chronic subluxation 	<ul style="list-style-type: none"> • Pathological changes in joint surfaces
Structural Aberration	<ul style="list-style-type: none"> • Classic inter-articular disrelationship between joint surfaces • Joint components abnormally at rest and • “forced into an awry attitude” • Example: Lateral flexion malposition 	<ul style="list-style-type: none"> • Inability for body to adapt and compensate

Fig 4. A. Reinert's 3 types of subluxation.

majority of disease syndromes.”⁹ In his book, he built upon the idea that the role of the body's Innate Intelligence was to comprehend itself and its environment. He suggested that the CVS interfered with this comprehension, leading to “dis-ease,” disturbed equilibrium, lowered tissue resistance, lack of function, and an overall disturbance in the nervous system's control of the body.⁹ He linked this theory to classic models from the PSC, including the Meric system, tone, and the 9 primary functions. Barge hypothesized that musculoskeletal pain syndromes were the body's way of warning, which might be used to direct the practitioner to the CVS. He emphasized the 4-part model developed by B. J. Palmer,²⁵ whereby CVS includes misalignment, occlusion, pressure, and interference.

Reinert's Theories (1984-1993). Otto Reinert graduated from Missouri Chiropractic College (MCC) in 1933. Reinert became dean of MCC in 1962 and then president. Henry Haring was president of MCC while Reinert was a student. Haring graduated from St. Louis Chiropractic College in 1926, during which time L. W. Ray was president and Alva Gregory was the lead teacher. The Palmer-Gregory Chiropractic College had merged with St. Louis Chiropractic College in 1913. Thus, Reinert's professional lineage can be traced back to Gregory, who was a student of Carver and learned from D. D. Palmer for 9 weeks.²⁶

In 1984, Reinert proposed a CVS model of the cervical spine C2 to C7.¹¹ To develop his model, Reinert integrated White and Panjabi's 1978 text on spinal biomechanics and several models of intervertebral discs from the 1970s.¹¹ He theorized that there were 3 important components to CVS: hypermobility, structural aberration, and hypomobility. He proposed that each was different and demanded individualized management. According to Reinert, hypermobility included a failure of ligaments to restrain the joint and a range of motion beyond natural limits. This could lead to

neurological and circulatory disturbances. Structural aberration was the classic interarticular disrelationship between joint surfaces. Hypomobility or fixation of the joint itself was suggested to be a chronic CVS with pathological changes. He explored the anatomy of each topic with diagrams and x-ray examples (Fig 4).¹¹

In 1988, Reinert published an article on the sacroiliac subluxation as a pretender.¹² He described a rationale based on research at Logan with motion studies, dissection, and full-spine x-ray. He wrote, “The hypothesis herein presented, that sacro-iliac ‘subluxation’ does not exist as a true entity.”¹² He purported that the apparent success of many techniques from Logan to Gonstead was due to indirect correction of lumbar CVS. The change in the lumbar influences any change in presumed sacral-iliac symptoms. Reinert challenged the profession to hold a conference on his findings to determine profession-wide agreement and standardization of methods.¹²

In 1993, Reinert expanded on his findings and proposed a hypothesis of the lumbar spine.¹³ Based on his selected references, he made a compelling case for the role of intervertebral disc in lumbar CVS. He referred to the process of correction as “discoplasty,” and he hypothesized that the nucleus of the disc shifts posterior with flexion, and with extension it may do the reverse. He proposed that this could lead to sacroiliac symptoms and suggested that passive extension should be used by chiropractors.¹³ Reinert's attempt to rewrite the anatomy of the sacral subluxation should be analyzed based on his use of the literature at the time.^{12,13}

His theory of the sacral pretender directly challenged the models that were central to Logan's Basic Technique. Logan described that the sacrum subluxated anterior and inferior.²⁷ Reinert felt this was impossible and that the observed symptoms were more likely due to a lumbar

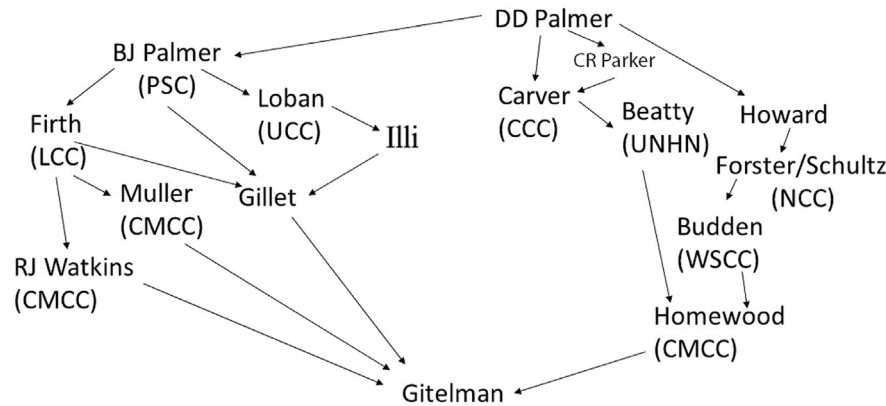


Fig 5. Teacher-student relationships from D. D. Palmer to Gitelman.

CVS.^{12,13} Reinert and Logan were forced to merge their schools in 1964.²⁶ Reinert became the head of the technic department at Logan,²⁶ and decades later, with this new theory about sacral subluxation, he worked to change the core theories of the Logan model.^{12,13}

Reinert's article "Sacro-iliac Subluxation: The Masked Pretender?" did not reference Kapandji's biomechanical studies of the sacroiliac joint or R. J. Watkins' papers on pelvic mechanics.^{28,29} Kapandji and Watkins both demonstrated sacroiliac motion in the 1960s. In 1995, Panzer and Gatterman published a chapter on the sacroiliac subluxation syndrome, which referenced Kapandji in their literature review.³⁰ The models of Watkins, Panzer, and Gatterman demonstrate that Reinert's sacroiliac hypothesis was not well supported by the literature. Reinert's other models of cervical and lumbar CVS may have merit for future study, model building, and technical application.^{11,13}

Gitelman's Somatovisceral Model (1984). Ron Gitelman was a 1961 graduate of CMCC and a student of both Homewood and Gillet (Fig 5). In 1965, he became the academic dean of CMCC, and from 1967 to 1977 he was director of research. Gitelman was instrumental in supporting research with Peterson's synchro-therme. In 1972, he started gathering "the archives" at CMCC with a focus on collecting all literature that supported the science of chiropractic³¹(Fig 5).

By 1984, Gitelman and Don Fitz-Ritson, a 1979 graduate of CMCC, suggested that based on scientific evidence, chiropractic had an important role to play in visceral disease.¹⁰ Gitelman and Fitz-Ritson described the intertwined connections between the autonomic system and somatic activities. They thought this was represented by intersegmental reflex mechanisms that were distributed throughout the body. They referred to the literature on somatovisceral reflexes in the work of Kuntz, Schmidt, Korr, Sato, and Coote. The last 2 authors had chapters in Haldeman's 1980 text, as did Gitelman.³² The 1984 article referred to CVS as a functional pathology of the locomotor system that may be related to visceral disorders via somatic sympathetic reflexes, intersegmental reflexes, and

suprasegmental reflexes, as well as somatocardiac, somatogastric, and somatorenal reflexes.¹⁰

Gitelman and Fitz-Ritson proposed 4 ways this might occur (Fig 6). The first was that vertebrogenic disorders and the related reflex systems could mimic disease processes. One example is pseudo-anginas related to lower cervical CVS. The second class included vertebrogenic lesions where CVSs are symptoms of internal disorders. Differential diagnosis relies on case history and symptomatology. The third type was proposed to be seen with chronic visceral diseases. The visceral somatic end of the reflex resulted in spinal dysfunction, which may continue after the internal disease process had gone. They proposed that these reflex changes were more extensive than with vertebrogenic lesions because multiple spinal segments were involved at various spinal levels. The final classification they proposed was when CVS directly caused internal disorders. They felt it would be possible to research this and recommended that the profession commence interdisciplinary clinical trials (Fig 6).¹⁰

Groscopic's Dentate Ligament–Cord Distortion Hypothesis. In 1988, John D. Grostic, son of John F. Grostic, developer of the Grostic Technique for upper cervical analysis, proposed the dentate ligament–cord distortion hypothesis. J. D. Grostic was director of research of the Sid E. Williams Research Center at Life Chiropractic College (LCC) and founder of the *Chiropractic Research Journal*. In the first issue of the *Chiropractic Research Journal*, he proposed the hypothesis.¹⁴

Grostic suggested that compression and proprioceptive models were inadequate to explain phenomena associated with upper cervical chiropractic care. He cited Homewood's description of proprioceptive insult related to the irritation of CVS and observed that this model did not explain the many clinical changes noticed by upper-cervical practitioners, especially related to symptoms of the lower spine and extremities, as well as other clinical observations such as warmth and "mild electric shock" in the lower extremities.¹⁴ J. D. Grostic wrote:

The Dentate Ligament – Cord Distortion Hypothesis, utilizes the unique anatomy of the cervical spine to

Classifications	Reflex Action	Defining Statement
Vertebrogenic disorders	Reflex Changes imitate internal disease	<ul style="list-style-type: none"> No organic disease Symptom picture mimics a visceral disorder
Vertebrogenic lesions	Reflex changes develop during acute stages of internal disorder	<ul style="list-style-type: none"> Subluxations that are symptoms of visceral dysfunction Result of nociceptive muscle spasm causing aberrant mobility Leads to secondary subluxation
Chronic State of Visceral Disease	Extensive reflex changes affect more segments and multiple spinal levels	<ul style="list-style-type: none"> Disordered viscera establishes the visceral somatic end of the reflex spectrum leading to spinal dysfunction Pain pattern and symptomatology may be perpetuated after the internal dysfunction has subsided
Internal diseases and visceral pathology caused by vertebrogenic lesions and their reflex effects	Makes the internal organs corresponding segments more susceptible to other noxious impulses	<ul style="list-style-type: none"> Clinical manifestations more likely to occur Research could establish chiropractic as "the most powerful prophylactic system of health delivery in the world."

Fig 6. *Gitelman and Fitz-Ritson's 4 categories of CVS-related reflex processes. CVS, chiropractic vertebral subluxation.*

provide a model which explains how a misalignment of C-1 or C-2 can produce neurological insult directly via mechanical irritation of the spinal cord, and indirectly via vascular compromise of the cervical cord. This hypothesis states that misalignments of the upper cervical vertebrae, because of their unique attachments to the spinal cord by means of dentate ligaments, can directly stress and deform the spinal cord.¹⁴

In describing the hypothesis, J. D. Grostic addressed the literature in relation to what was known about dentate ligament attachments to vertebra in 1988 and other ways the ligament may distort the cord. He built upon previous research from B. J. Palmer's cord pressure model; the upper cervical approaches developed by J. F. Grostic, Gregory, and Sweat; as well as the Breig paradigm of adverse mechanical cord tension. J. D. Grostic proposed that the neurological significance of this hypothesis would help to explain many clinical phenomenon commonly found by upper cervical practitioners, which may be related to the upper cervical cord in relation to spinal-thalamic tracts and neurological structures.¹⁴

Integrating Models (1980-1994)

Several new approaches to integrating the various CVS models emerged at this time. This section summarizes 2 examples: Gatterman's approach to indications and contra-indications for treatment of pain-related CVS fixations and Leach's *Chiropractic Theories*.

Gatterman's Indications (1982). Meridel Gatterman graduated from Western States Chiropractic College (WSCC) in 1976. She was director of the division of chiropractic science at WSCC from 1978 to 1980, and by 1992, she held that same title at CMCC.^{15,33} In 1982, Gatterman published a paper with clinical indicators for spinal manipulation for treatment of back pain.¹⁵ She relied on Gillet's fixation as

the CVS definition and also cited a large portion of the current orthodox scientific literature as well as CVS literature from Faye, Sandoz, Vear, Homewood, Drum, Grice, and Nimmo, and older works like Carver, Budden, and *Modernized Chiropractic*. Her article may have been the first in the modern literature to note Smith, Langworthy, and Paxson's motion field approach to CVS.³⁴ Gatterman proposed that there was enough evidence to be precise and predict success in treating back pain by distinguishing among locked joints, hypermobile joints, and instability. In doing so, she suggested that chiropractic adjustments might be used for other purposes aside from pain management. She wrote:

The localized effects of such manipulation may be normalization of joint mobility and nerve function, in addition to pain reduction, with frequent compensatory changes in other areas of spinal function. The secondary effects can include changes in peripheral neurological function and may include relief from somatic pain syndromes, nerve compression syndromes, functional disorders of visceral origin, autonomic pain syndromes and psycho-somatic syndromes.¹⁵

Gatterman summarized several therapeutic methods used within the profession for treating pain. Gatterman's emphasis on hypo- and hypermobility CVS did not include a description of what Howe and Watkins referred to as the reversal CVS, which was proposed to resolve with reflex adjustments.^{28,35} Gatterman limited the usefulness of the reflex adjustment to the relief of pain syndromes from referred sites, which was consistent with the article's overall focus on pain relief.

Leach's Chiropractic Theories (1980-1994). Robert Leach graduated from LCC in 1978. He studied at LCC while R. J. Watkins was vice president of academic affairs and also chairman of the curriculum, research, and academic standards committees. Watkins was a 1942 graduate from Lincoln



Fig 7. Leonard Faye.

Chiropractic College, during which time Firth was president. LCC was founded by Sid Williams, a 1957 graduate of PSC. Williams asked Watkins to design the entire curriculum.²⁸ Some influence of Watkins' models was evident in Leach's first edition of *The Chiropractic Theories*, published in 1980. The second edition was published in 1986, the third in 1994, and the fourth in 2004.³⁶

In 1981, Leach summed up his textbook in a short article.³⁷ He provided a summary of theories up to 1980, which included nerve pressure, somatoautonomic pathways, vertebral artery dynamics, axoplasmic transport, and neurodystrophic phenomena. He suggested that the chiropractic theories were based on empirical and experimental evidence and that "the vast majority of studies of manipulation are unblinded."³⁷ The information implied that upper cervical CVS altered cord function and that lower cervical and lower lumbar CVS caused derangement of spinal nerves. To evaluate the theories further, he suggested research should be clinically controlled and blinded.³⁷ In the third edition of his text,³⁸ Leach attempted a comprehensive overview of all of the latest research on the topic. The book included a section and an appendix on the VSC; new sections on segmental dysfunction, hard and soft measures of dysfunction, and the facilitation hypothesis; and sections on practitioner/scientists and clinical outcomes research.

Subluxation Complex (1981-1995)

The acknowledgment by many in the profession in the last few decades that subluxation might best be described as the VSC started during this era. Several theorists were already referring to CVS as a complex.³⁹⁻⁴² The term "vertebral subluxation complex" was coined by Ralph Gregory to describe the misalignment as well as the connective tissues associated with the joint.⁴³ Gregory referred to the atlas subluxation complex syndrome, which he believed to be detectable by objective signs that were "activated" when there was a C1 CVS.⁴⁴ The first person to describe the VSC in distinct components and based on the latest literature was Faye.⁴⁵ His model was developed further by Dishman, and then Lantz popularized the modern term VSC.³

Faye's Vertebral Subluxation Complex (1981-1995). Leonard J. Faye graduated from CMCC in 1960 while Homewood was president (Fig 7). Faye practiced in England and studied with Gillet in Switzerland. Faye began teaching Gillet's motion palpation (MP) at the new Anglo European College of Chiropractic (AECC) in Bournemouth, England in 1967. He moved back to Canada in 1976 and taught MP for 1 year at CMCC. In 1979, he taught courses in the United States, which were based on Gillet's *Belgian Notes*.⁴⁵ Faye added x-ray material and insights from the latest literature. His notes were written down in 1980 and updated in 1983.¹ The notes contained one of the first references in the chiropractic literature to Breig's 1960 text on the biomechanics of the central nervous system.⁴⁶ Faye gave the keynote at the first annual ACA Technic Council in 1983 (Fig 7).⁴⁷

In 1966, Faye may have derived the VSC concept during preparation for his course at AECC.⁴⁸ He had read a paper from the *Journal of the ACA* on the model including neurobiology and joint dysfunction. It is not certain, but this may have been the CVS terminology brief compiled by R. J. Watkins and developed in 1966 by the first diplomates of the American Board of Chiropractic Roentgenologists,⁴⁹ or the initial meetings in 1965 of the Commission for the Standardization of Chiropractic Principles of the ACA composed of Bittner, Weiant, Harper, Janse, and Homewood.^{42,49-51} The definitions from both of these groups differentiated biomechanical from neurological and physiological components.^{52,53}

Faye included 5 components in his model: biomechanical, neurological, muscular, inflammatory, and the stress response. He wrote:

In 1967 at the Anglo- European Chiropractic College I developed class notes that quoted the following authors: Breig, Janda, Lewitt, Illi, Gillet, Wyke, Grice, Mennell, Sandoz, Homewood, Selye, Panjabi, White, and many others that were references for the subluxation complex model. The art of marrying the biomechanical, neurobiological, pathological, musculoskeletal, inflammatory and stress related research

5-Part Subluxation Complex	Pathophysiological Changes
Neuropathophysiology	<ul style="list-style-type: none"> • irritation/facilitation pathway via the Anterior, Lateral, or Posterior horn and • lead to hypertonic muscles • changes in the sympathetic vasomotor and sensory systems • may take the path of pressure/degeneration, • which leads to atrophy, sympatheticotonia, and anesthesia
Kinesiopathology	<ul style="list-style-type: none"> • Gillet's hypomobility • Illi's hypermobility • Mennel's loss of joint play • Compensation could lead to a combination of hyper and hypo mobility in the same motor unit.
Myopathology	<ul style="list-style-type: none"> • could be in the form of atonia or spasm, • which may be due to compensation • facilitation • or due to the feedback changes in the nerves controlling the muscles of the joint • Muscle spasm may lead to an activation of the visceromotor reflex.
Histopathology	<ul style="list-style-type: none"> • inflammatory process • edema
Biochemical	<ul style="list-style-type: none"> • related to the stress response including: • release of histamine, prostaglandins, and kinins

Fig 8. The 5 changes associated with Faye's subluxation complex.

into a uniquely chiropractic paradigm was a challenge to say the least.⁴⁷

Faye's model included muscle changes like spasms, hypertrophy, atrophy, and degeneration along with inflammatory responses based on Selye's stress syndrome.⁴² He wrote:

Rational explanation as to why some of our patients were observed to gain health benefits after suffering organ disease. These responses occurred not because of a simple relationship between a spinal nerve and the organ, but for much more complex reasons tied to the physical, mental and chemical causes, reducing the effects of stress and gaining the patients' confidence that instilled hope; all had a role to play.⁴²

Faye's model was congruent with those from previous theorists that CVS may lead to pathophysiology and then pathology.^{1,54} He hypothesized that normal physiological processes would be restored and the pathology would reverse by correcting the CVS. He proposed that the objective was to develop an examination rationale to look at the locomotor system as a whole with the spine as "part of a closed kinematic system."⁴² The rationale for adjusting included finding the fixation, mobilizing the fixation, and rechecking to confirm improvement. Faye described the CVS as "a complex clinical entity," comprising pathophysiological changes associated with "one or more of the following: Neuropathophysiology, Kinesiopathology, Myopathology, Histopathology, and Biochemical" (Fig 8).¹

In the 1990s, Faye reflected on 16 years of teaching MP.⁴⁷ He reasoned that the poor interexaminer reliability of MP may be due to his omission in teaching how to determine the

lingering pain sign. Faye never emphasized this pain response of inflamed joints because he assumed everyone could feel the fixation.⁴⁷ MP was developed to discover only 1 of the 5 components of the VSC. Case history, exam, x-ray, and lab procedures were developed to capture the other 4.

In the 1980s, Faye toured the country giving seminars and started *Dynamic Chiropractic* with his partner, Don Peterson, Sr. The publication was sent to every chiropractor in the United States. In 1989, Faye coauthored *Motion Palpation and Chiropractic Technic: Principles of Dynamic Chiropractic* with R. C. Schafer,⁵⁵ author of the ACA's *Basic Chiropractic Procedure Manual*.⁵⁶ In 1988, the president of the ACA wrote, "The ACA has always supported and emphasized the vertebral subluxation complex and its component parts as the foundation of chiropractic."¹⁶

Dishman's Chiropractic Subluxation Complex (1985-1988). Robert Dishman was a 1941 graduate of Southern California Chiropractic College while Clifford Eacrett was president. Eacrett was a 1925 graduate of Los Angeles Chiropractic College (LACC) when Charles Cale was president. Cale was taught by D. D. Palmer's student Thomas Storey.²⁶ Dishman was dean of Hollywood College of Chiropractic, which merged with LACC in 1962.

In 1985 and 1988, Dishman built upon Faye's model. Dishman called it the CSC.² He suggested that approaching CVS as a complex would allow researchers to study the clinical entity. Dishman started his review by proposing a chiropractic postulate from Faye: "The chiropractic subluxation complex (CSC) causes pathophysiology, which in turn causes pathology. Correction of the CSC restores normal physiological processes and the reversible pathology reverses."² His intention was to describe the literature on neurobiomechanical dysfunction as a component of

CSC. He then explored the literature on the 5 components of subluxation complex: kinesio pathology, neuropathophysiology, myopathology, histopathology, and biochemistry.

The emphasis of the 1985 review was the neuropathophysiological component. He included Speransky's approach to nervous disturbance,⁵⁷ Suh's nerve compression research,⁵⁸ and Korr's facilitation research.⁵⁹ He wrote, "The osteopathic lesion and chiropractic subluxation represents a facilitated segment of the spinal cord maintained by endogenous impulses entering the corresponding dorsal root."² He cited Sato's research on somatovisceral and somatosympathetic reflexes.⁶⁰ Dishman theorized that the mechanisms involved in a chiropractor's daily practice were so complex that a detailed understanding should be part of chiropractic training, especially because the segment of the spinal cord that was subluxated may be hyperexcitable.² This excitation could magnify through all of the various reflex systems associated with it. The lowered threshold at the segment should be taken into account during clinical intervention, especially regarding improving the "afferent input so that sympathetic hyperactivity is alleviated."² The chiropractic adjustment, he proposed, affects the kinesio component directly and the other components indirectly. The CSC was viewed by Dishman as a new paradigm for future research.

Lantz's Vertebral Subluxation Complex Model (1988-1995).

Charles "Skip" Lantz earned a PhD in pharmacology from the University of North Carolina in 1977 and graduated from LCC in 1987. In 1988, he worked at the Sid E. Williams Research Center at LCC. In 1990, Lantz was appointed the director of research at Life Chiropractic College West (LCCW). He felt that the conflicting ideas in chiropractic were due to the complexity of the topic and called for an expanded research agenda to study the mechanisms of CVS.^{3,4,61}

In 1988, Lantz wrote a literature review exploring Gillet's fixation hypothesis in relation to every facet of joint degeneration owing to immobilization.⁶¹ The emphasis was on biochemical changes to the connective tissues and their relation to biomechanical and functional properties of the tissues. It was an attempt to provide "a molecular basis for the theory and practice of chiropractic."⁶¹ Lantz emphasized the effect of remobilization on the joint. Lantz attributed the SC to Dishman's CSC, rather than to Faye, who developed it. Lantz preferred the term VSC used by Luedke, in 1988.^{3,16}

The immobilization degeneration model developed by Lantz emphasized the role of time. He suggested that it took time for degeneration to happen and it would take time to reverse the process. He proposed that the effects of inflammation and connective tissue changes should be evaluated by chiropractic researchers and include elements of the joint with an emphasis on the disc and also the role of the meninges, which are made of connective tissue.⁶¹

In 1989 and 1990, Lantz outlined his VSC in greater detail^{3,4}; he felt that there was enough literature in the

previous 2 decades to determine that CVS was "a real entity."³ Subluxation should be viewed as a dynamic process involving several levels of tissues and integration. Lantz suggested that the main controversies were not whether it exists but rather identifying the neurological involvement.

Lantz added several components to the 5-part VSC model. He proposed an 8-component model, which included the functional components like kinesio pathology and the inflammatory response; the tissue-level components such as neuropathology, myopathology, and connective tissue pathology; and vascular abnormalities. The histopathology included the structural component and biochemical abnormalities, which form the biochemical component. The VSC emphasized the immobilization degeneration process and the organizational hierarchy.

In 1995, Lantz contributed a chapter on the VSC in Gatterman's textbook.¹⁹ The chapter built upon Lantz's earlier writings with an emphasis on clinical relevance and the addition of pathophysiology to the model.¹⁹ In the second edition published in 2004, the chapter was replaced by a chapter of the same title, *Vertebral Subluxation Complex*, but the authors are Seaman and Faye.⁶²

Efforts at Consensus (1987-1995)

The history of consensus statements on CVS goes back to 1905. According to Drain, until that point chiropractors viewed CVS as the cause of disease, but after a convention, it was determined that "a subluxation was only the physical representative of the cause of disease, that the real cause of disease was lack of mental impulse being expressed in the tissue cells."⁶³ B. J. Palmer may have been the first to publish this particular definition and that it was "the physical representative of the cause of disease."⁶⁴ The first public talk using that definition may have been B. J. Palmer's student G. H. Patchen in 1907.⁶⁵ However, it was not until the 1960s and 1970s that CVS consensus statements were developed.^{49,53} These statements influenced the definitions of the 1980s and 1990s.

In 1987, the ICA defined CVS as: "Any alteration of the bio-mechanical and physiological dynamics of the contiguous spinal structures which can cause neuronal disturbances."¹⁷ This definition was consistent with the literature dating to the 1966 distinction made by the early radiologists.⁴⁹ It distinguished the anatomical and physiological elements of the CVS from the neurological consequences.

At about the same time, CVS was defined by the ACA in 1988 as:

An aberrant relationship between two adjacent articular structures that may have functional or pathological sequelae, causing an alteration in the biomechanical and/or neurophysiological reflections of these articular structures, their proximal structures, and/or body systems that may be directly or indirectly affected by them.⁶⁶

Delphi Panel Agreement	Definition
88%	<ul style="list-style-type: none"> • <i>Motion segment</i> – A functional unit made up of the two adjacent articulating surfaces and the connecting tissues binding them together
83%	<ul style="list-style-type: none"> • <i>Spinal motion segment</i> - Two adjacent vertebrae, and the connecting tissues binding them to each other
84%	<ul style="list-style-type: none"> • <i>Subluxation</i> – A motion segment, in which alignment, movement integrity and/or physiological function are altered although contact between joint surfaces remains intact.
81%	<ul style="list-style-type: none"> • <i>Manipulable subluxation</i> – A subluxation in which altered alignment, movement and/or function can be improved by manual thrust procedures
82%	<ul style="list-style-type: none"> • <i>Subluxation complex</i> – A theoretical model of motion segment dysfunction (subluxation) which incorporates the complex interaction of pathological changes in nerve, muscle, ligamentous, vascular and connective tissues.
83%	<ul style="list-style-type: none"> • <i>Subluxation syndrome</i> – An aggregate of signs and symptoms that relate to pathophysiology or dysfunction of spinal and pelvic motion segments or to peripheral joints.
91%	<ul style="list-style-type: none"> • <i>Manual therapy</i> – Procedures by which the hands directly contact the body to treat the articulations and/or soft tissues
91%	<ul style="list-style-type: none"> • <i>Manipulation</i> – A manual procedure that involves a directed thrust to move a joint past the physiological range of motion, without exceeding the anatomical limit.
88%	<ul style="list-style-type: none"> • <i>Mobilization</i> – Movement applied singularly or repetitively within or at the physiological range of joint motion, without imparting a thrust or impulse, with the goal of restoring joint mobility
87%	<ul style="list-style-type: none"> • <i>Adjustment</i> – Any chiropractic therapeutic procedure that utilizes controlled force, leverage, direction, amplitude, and velocity which is directed at specific joints or anatomical regions. Chiropractors commonly use such procedures to influence joint and neurophysiological function.

Fig 9. Agreement and definitions of 10 terms proposed at the 1991 Conference on Research and Education.

This ACA definition was an update to the 1973 ACA definition.⁵³ It included some of the latest models of reflex theory, differentiations between articular disrelationships and neurological dysfunctions, and the effects on body systems. This definition was approved by the House of Delegates in July 1987. In January 1988, the ICA and ACA agreed to present this definition to the World Health Organization.¹⁶

In 1991, CMCC initiated a 3-year consensus process to establish chiropractic terminology. Initial consensus terms were presented to a panel at the Conference on Chiropractic Research and Education in Monterey, California, and then to representatives from the Consortium for Chiropractic Research. Members of the Consortium on the panel were from CMCC, LCCW, Logan, Northwestern Chiropractic College, Palmer Chiropractic College West (PCCW), and WSCC and included a chiropractic student and a practicing chiropractor. A consensus process was initiated with an international panel of 60 people, including practicing chiropractors, members of the Research Consortium, and the Advisory Council on Technic. The representatives were from Royal Melbourne Institute of Technology, AECC, WSCC, University of Bridgeport, Texas Chiropractic College, Parker Chiropractic College, Palmer Chiropractic College, PCCW, Northwestern Chiropractic College, National Board of Chiropractic Examiners, National Chiropractic College, Motion Palpation Institute, LACC, Logan, LCCW, LCC, Foundation for Chiropractic Education, Council on Technic, Cleveland Chiropractic College,

Chiro Technique Journal, and the ACA; members of CMCC and members of Canada's Council on Chiropractic Education and Licensing Board.¹⁸

Greater than 80% consensus was found on every term (Fig 9). Four of the terms related to CVS or "the lesion treated by chiropractors"¹⁸: subluxation as the motion segment, the manipulable subluxation, subluxation complex defined as a "theoretical model" incorporating various pathological components, and subluxation syndrome or the signs and symptoms characteristic of subluxation pathophysiology of dysfunction. Journals and associations adopted the consensus definitions (Fig 9).^{18,20}

In 1995, Gatterman published the *Foundations of Chiropractic Subluxation*,¹⁹ which was the culmination of the "Subluxation Revisited" conference at CMCC in fall 1992. The book was dedicated to Homewood. The foreword was written by Vear, president of CMCC. He wrote, "This text is destined to become the authoritative work on the vertebral subluxation until such time as it is revised to include new research or refute material that is questioned by new investigative study."¹⁹ Gatterman emphasized that these definitions were not carved in stone but would continue to evolve. The book expanded upon the definitions from the consensus with 3 main sections: subluxation, subluxation complex, and subluxation syndromes. Gatterman coined *subluxation syndrome* in 1992 to differentiate it from the confusing term *complex*, which is often used in psychology. *Syndrome*, she argued, encompassed disease states or physical states.¹⁹

Critical Analysis

Several papers from this period require critical analysis because they are still cited in the literature. In addition, the literature from this era introduced new calls for validity and reliability studies. Some of the papers relied on early studies to support their arguments. Those arguments and the studies that rely on them should be scrutinized based on the most current research protocols and available data.

Theory Commonalities. There were commonalities throughout the CVS theories. For example, pathology as “modified physiology,” also known as *pathophysiology*, originated with D. D. Palmer.⁵⁴ This concept is found in the theories of Faye and Dishman,^{1,2} and their predecessors like Ratledge,⁶⁷ Loban,⁶⁸ Harper,⁵⁰ and Watkins.²⁸ Although Faye and Dishman suggest that the CVS led to pathophysiology, Triano proposed that CVS was a complex part of other pathologies and should be termed “functional spinal lesion.”^{1,2,69} Triano suggested that the overall CVS may be a subcomponent to other pathologies such as disc, facet, and soft tissue disorders, and concluded that because of its complexity, outcome measures were indirect. Triano wrote, “As outcome measure, then the subluxation complex can only be quantified by characterizing each of the associated findings independently.”⁶⁹ He noted that every element of the subluxation “complex” should be studied as an independent outcome measure in the context of the patient’s overall function.⁶⁹ He proposed that outcome measures related to the patient’s mobility, self-care, and function.⁶⁹ Both approaches to pathology and pathophysiology still warrant investigation.

Another commonality was the idea that excitation could reflect and magnify through the nervous system across reflex pathways, leading to various abnormalities and dysfunctions. This was found in Dishman’s model based on Korr’s facilitation and sympathetic hyperactivity.^{2,59} Similar concepts could be found in Homewood and Muller and ultimately go back to Verner’s theory of a feedback at the subluxated joint or “spillover” via the spinal cord and the internuncials.⁷⁰⁻⁷² Gitelman added several viscerosomatic reflex theories to this approach.¹⁰ As director of research at CMCC, he supported the publication of *Segmental Neuropathy*,⁷³ which could explain why his CVS theories were congruent with the text.³¹ Gitelman’s conclusion with Fitz-Ritson was that CVS led to various visceral disorders.¹⁰ This conclusion was also reached by the chiropractic pioneers based on their observations of clinical findings.^{54,68,74-78}

Review of Critical Literature. During this period, there was an increase in critical literature. Several papers were published during this time calling for more validity studies and changes to definitions of CVS terminology.⁷⁹⁻⁸⁴ Two examples are Brantingham and Charlton.

In 1984 and 1985, Brantingham wrote literature reviews on chiropractic hypotheses and “the chiropractic lesion.”^{79,80} He graduated from LACC in 1983 when Howe was chair of radiology. Citing the 1979 New Zealand Commission Report

on Chiropractic,⁸⁵ Brantingham observed that confusion existed around terminology, especially because of the widely accepted medical definition of the term *subluxation*. He proposed a new term based on reference to Sandoz’s description of an “interarticular dysfunction.”⁸⁶

Brantingham referred to intervertebral hypomobility, hypermobility, displacement, and reversed erratic motion.⁸⁰ Those aspects of CVS were derived in part from the work of Watkins, Howe, and other chiropractic radiologists.^{39,49,87-89} However, Brantingham did not include the other radiologists’ definitions, which included neurophysiological dysfunction.^{49,80} He asked, “Should the chiropractic profession accept the work of Korr, Denslow, Gillet, Gitelman, Howe, Lewit, Jirout, Haldeman, Grieve, Mennel, Stoddard, and Cassidy?”⁸⁰ And yet, many of those researchers emphasized the neurological dysfunction while he omitted it.

Brantingham explored the etiology of hypomobility along with questions about restricted motion, such as swelling, inflammation, tight muscles and ligaments, pain, and also nerve root and autonomic irritation.⁸⁰ He reasoned that the term *subluxation* alone was not comprehensive enough to capture the variability and complexity of his concerns and suggested the term should be abandoned. He hypothesized that if slight CVS could not be detected on plain-film x-rays, their replacement through manipulation could not be confirmed.^{79,80} Thus, he felt that the term *subluxation* should only be used in its classic medical definition. By 1988, he proposed that the manipulable joint lesion could be demonstrated and so the osteopathic term *somatic dysfunction* should replace CVS.^{80,81,90}

Keith Charlton, a 1975 graduate of National Chiropractic College, reviewed the literature on manual diagnosis of CVS for various pain syndromes.⁸³ Charlton considered cardiology research as the gold standard that manual methods should aspire to emulate. He wrote, “There is a chasm between morphological research and manual practice.”⁸³ He relied on Gillet’s model of fixation or “a dynamic notion of restriction of joint movement” with “the old static concept” of bone out of place.⁹¹ However, out of 94 references, the only chiropractic references in his paper include some editorials,⁹²⁻⁹⁴ Haldeman’s text,³² several reliability studies,⁹⁵⁻⁹⁸ the National Institute of Neurological and Communicative Diseases and Stroke proceedings, and the follow-up workshop.^{99,100} From this limited review of the chiropractic literature, Charlton concluded that no CVS researchers “have been able to prove the existence of it as an independently verifiable, clinically significant entity.”⁸³ Charlton suggested that imaging studies and reliability studies for manual diagnosis lack any consistent findings beyond anecdotal or intuitive methods and that chiropractic has not come up with any reliable ways to study manual diagnosis.⁸³

Shift in Perspective on Subluxation. In 1984, R. J. Watkins gave the keynote address at the second annual ACA Technic Council. Watkins was head of the chiropractic principles department at Cleveland Chiropractic College-Los Angeles. C. S. Cleveland asked him to emphasize

specificity in his talk. The title of the talk was “Gentleman, Your Chiropractic Is Too Small.”²⁸ Watkins implored the heads of technique departments from most of the schools that the chiropractic adjustment must be specific and aimed at retuning the neurophysiological coordination. He emphasized accurate palpation and nerve tracing along with instrumentation to determine the site of CVS.²⁸ Watkins wrote:

Subluxation is a new and unstable neurological entity with all its neuromuscular imbalance, abnormal heat pattern, distorted visceral function, and perverted sensations to its periphery, as well as symptomatic pain. The normal joint with the normal physiology is much more stable. Hence the one or even six spinal subluxations are like dominoes up on end. The normal spinal joints are like the stable dominoes lying flat. Jarring the table, shaking the floor, or turning on a fan to blow across the table will be MUCH more likely to stabilize everything by flattening the “on end” dominoes than it will be to upend the flat ones. It is generally easier to “fix” than to “unfix” spinal alignment. But of course one has to find the fault before he can fix it. Hence the need for palpation and nerve tracing which are basic fundamental arts to be continually practiced and improved.¹⁰¹

After the conference, Watkins sent his observations about the changes in the profession’s attitude to Carl Cleveland. Watkins summed up a major shift in perspective by reporting his “startling revelations” to Cleveland as 3 distinct phenomena: a representative from ACA’s Foundation for Chiropractic Education and Research claimed that chiropractic had not proven its efficacy, others questioned why the CVS must include a neurophysiological component, and some promoted the term “manipulable lesion” to replace CVS (Fig 10).²⁸

In 1986, Harry Rosenfeld, Esq., legal counsel to the ACA, wrote an article titled “Planning for Chiropractic’s Future.” Point 3 of his 10-point prescription was “Is Subluxation Necessary? Has chiropractic matured sufficiently as a profession to eliminate its traditional relation with subluxation?”¹⁰²

Historical Accuracy and Completeness. The phenomena R. J. Watkins pointed to suggested there was a lack of deep knowledge among his colleagues about research and theory since the 1950s. This was highlighted in some of the literature from the period. Several potential errors about the early chiropractic theories of the Palmers were referenced and re-referenced in the literature during this time. One common error was defining D. D. Palmer’s theory as “a bone out of place” (BOOP), rather than his definition, which was the disrelationship between 2 bones, or a joint, impinging on a nerve, causing pressure and too much or not enough function.^{54,103}

3 New Phenomena Noted by R.J. Watkins in 1984
1. New claims that chiropractic had not proven its efficacy.
2. Questions about why subluxation needed to include a neurophysiological component.
3. Promotion of the term manipulable lesion to replace subluxation.

Fig 10. Phenomena observed by Watkins in 1984.

In the first edition of his book, Leach attributed BOOP to D. D. Palmer and suggested modern chiropractic focuses on the joint.¹⁰⁴ A more accurate depiction would be that modern CVS focused on the joint because researchers like Verner, Watkins, Harper, and Homewood cited D. D. Palmer.^{28,50,70,71} Charlton also used BOOP to describe early chiropractic⁸³; however, there were some problems with the references used to support his work. Charlton wrote, “The chiropractic profession has begun to refine the old static concept of a ‘bone out of place’ with a dynamic notion of restriction of joint movement, the so-called fixation.”⁸³ The 2 references that should be examined to support his opinion on BOOP were in a book attributed to B. J. Palmer called *The Science of Chiropractic*,⁶⁴ published in 1911, and Janse’s 1947 text, which was based on Forster’s 1915 book that covered CVS theory during the early years of chiropractic.^{74,105}

The problem was the page reference to a B. J. Palmer book reportedly published in 1911 and titled *The Science of Chiropractic*. Two books were published by Palmer in 1911: the second edition of Vol. 3 titled⁶⁴ *The Philosophy and Principles of Chiropractic Adjustments*, and Vol. 6 or *The Philosophy, Science, and Art of Chiropractic Nerve Tracing*.¹⁰⁶ Furthermore, Vols. 1, 2, and 4 all included *The Science of Chiropractic* as the primary title, and none had editions published in 1911.¹⁰⁷ Thus an examination of Palmer’s books from that era makes it difficult to determine what source Charlton was referring to. This difficulty is compounded by searching for the reference in either the first or second editions of any of B. J. Palmer’s first 6 books. None of those books mention the misalignment component of the CVS on the page cited, thus this may be an error of citation.^{23,24,64,108,109} Even though the reference does not match the material that Charlton was trying to support, B. J. Palmer did develop a more complex BOOP model, which included 3 vertebrae; the vertebra misaligned with the one above or the one below, causing pressure and interference to the spinal cord or spinal nerves.¹¹⁰

Regarding Charlton’s historical reference to Janse’s 1947 text,¹⁰⁵ most of the chiropractic definitions of that book were originally written between 1915 and 1923 by

Forster.^{74,111} The new sections of that book included chapters on reflex techniques and spondylotherapy.¹⁰⁵ Thus several other models beyond the BOOP were described in the book. However, Charlton did not include them, which limited his historical perspective of CVS to BOOP.¹⁰⁵

I also take issue with Lantz, who attributed “the initial conception of vertebral subluxation” to B. J. Palmer’s compression model.^{3,4} Although the compression model was one influential theory, there were several others, including B. J. Palmer’s cord pressure model,^{64,110} D. D. Palmer’s neuroskeleton model,¹¹² Smith’s tight ligament model,¹¹³ Smith and Langworthy’s motion field model,³⁴ Davis’ inhibition and stimulation model,¹¹⁴ and Carver’s full-spine model.¹¹⁵ In addition, O. G. Smith inspired Swanberg to do an anatomical study and publish on the intervertebral foramina,^{116,117} which showed that a hard bone on a soft nerve was unlikely. This motivated other noncompression and articular models, such as Verner’s theories in the 1940s.⁷⁰ These early models shared similarities and all were built upon and evolved. Lantz’s VSC is an evolution of all of them.^{3,4}

Further, in 1988, Brantingham critically analyzed the CVS hypothesis regarding pain and health care.⁸¹ Brantingham suggested that D. D. Palmer “derided spinal movement palpation as unnecessary.”⁸¹ He stated that because D. D. and B. J. Palmer did not emphasize function or biomechanics, the profession was set backward, which was why “even today many chiropractors and chiropractic colleges continue to talk about ‘subluxation’ with absolutely no reference to loss of function as pre-eminent.”⁸¹ However, D. D. Palmer also taught palpation for heat, alignment, and paresthesias (nerve tracing) as his primary analysis method. Palmer had a good understanding of the joint movements and developed his own theory of field of motion of CVS.^{54,118-120} In addition, normal and abnormal function were the main emphases for both Palmers.^{23,103} For example, Brantingham’s 1988 article led to a series of letters to the editor of the *Journal of Manipulative and Physical Therapeutics* from Lantz, Brantingham, and Keating.^{81,121-123} Lantz accused Brantingham of begging the question about CVS terminology and observed that the article did not include any chiropractic definitions of CVS.^{121,124} Lantz writes, “What references support his stance?”¹²¹ In response to Brantingham’s semantic changes to subluxation terminology, Lantz writes, “If we call a subluxation by any other name would it be any more real?” In another letter by Keating,¹²² he took up his call for research based on an operational definition, which was a call he would repeat into the 1990s, with notable impact on the literature.¹²⁵⁻¹²⁸

Calls for Reliability and Validity. The literature from this period included the first reliability studies of modern chiropractic and several studies from physical therapy research.^{83,129-131} For example, Charlton and Keating relied on this literature in their critiques.^{83,130,132} Some of the citation patterns in more recent calls to dismiss CVS as an historical

artifact can be traced to the early papers, which relied on reliability studies to support their arguments.^{130,133,134}

In 2009, Holt and Russell reported that extensive training of examiners increased reliability for the classic chiropractic leg length inequality examination.¹³⁵ Holt was a research fellow for New Zealand College of Chiropractic (NZCC), and Russell was the NZCC Chiropractic Centre director.¹³⁵ They found that 8 training sessions of 45-minute duration over 16 weeks were required to develop agreement between novice and experienced examiners. The World Federation of Chiropractic reported on this study and highlighted the importance of extensive training of students.¹³⁶ The World Federation of Chiropractic report noted that after 5 sessions the reliability was no better than random, but after the sixth training session reliability was good.

In 2010, Cooperstein, Haneline, and Young reported that reliability for MP across examiners increased when examiner confidence was included as a continuous dataset throughout the assessment.¹³⁷ Cooperstein is the director of research at PCCW.¹³⁸ When examiners felt “very confident” they had found the most fixated segment, reliability was good, unlike many previous studies showing poor reliability without including confidence as a factor.¹³⁷

In 2013, Cooperstein et al conducted a reliability study of MP that emphasized continuous measures of the “most clinically relevant spinal site,” as opposed to general segment-by-segment exam associated with most other studies.¹³⁹ They found good reliability. They suggested that future studies use a similar methodology because they conclude, “It may be possible to repeat many other interexaminer reliability studies, including studies of examination procedures other than MP (thermography, X-ray line marking, etc) with similar design modifications that may more meaningfully assess examiner agreement than the mostly discrete analysis that has been used up until now.”¹³⁹

Holt and Russell et al developed an interexaminer reliability protocol that combined the confidence rating, continuous measures, and extensive training.¹⁴⁰⁻¹⁴² After a period of training, patients were examined using multidimensional criteria.¹⁴¹ Two examiners were trained and asked to rate their confidence levels and determine site of cervical, thoracic, and lumbar CVS using leg checks, soft tissue palpation, joint play, and motion palpation assessments, and they found that reliability was good. Until older studies are repeated with these protocols, arguments that rely upon the limited earlier studies as evidence to support arguments about the veracity of CVS detection should be considered tentative.

Limitations

This work is limited by the interpretations of 1 author. Others may analyze this material differently and derive alternative conclusions. A review of conference proceedings published during this era may have yielded more sources for summary and analysis.

CONCLUSION

Research and theory of CVS should be based on accurate historical facts, rigorous scientific research, and the most informed theoretical models and methodological applications. Arguments for or against the use of CVS in chiropractic should be rooted in the literature both past and present.

Triano observed that research itself grows more complex along with the complexity of models and theories.⁶⁹ This observation was prescient. Each multiplication of CVS components and mechanisms increases the research challenges. Many theorists have made similar observations over the decades. It is the complexity of the CVS that makes it so compelling, enduring, and meaningful to the chiropractic profession.

By mastering the history of CVS theory, current chiropractors may be better able to integrate the current literature and develop research strategies to push the profession forward. Only by knowing the recent history of chiropractic ideas and how those ideas are rooted in the long tradition of research, model building, and practice can the profession truly come to terms with its many challenges.

In the 1990s, Faye challenged the profession to go beyond reliance on clinical outcomes and study the literature.¹ He cited many references that were used in developing his model such as Breig, Illi, Gillet, Grice, Sandoz, Homewood, Selye, Panjabi, and White, and then he wrote, "If these names are not familiar to you. GET READING. *Subluxation* by Meridel Gatterman, BSc, DC is a good place to start."⁴⁷ He also recommended Haldeman's text and Bergmann and Peterson's *Chiropractic Technique*.^{32,143} When Faye started teaching chiropractic seminars in 1980, he asked his students to commit 2 years to reading 1 hour per day to gradually master the scientific and chiropractic literature.⁴⁷

The same type of commitment is needed today for chiropractors to understand the history of CVS theory. The theories from this period should be understood in the context of the literature that came before them, the research and theories they relied upon, and developments they inspired. By understanding how CVS models, theories, criticisms, and consensus statements from this period developed, modern chiropractors may more readily be able to interpret the literature, apply theory to practice, and help to generate new research hypotheses.

ACKNOWLEDGMENTS

The author acknowledges Brian McAulay, DC, PhD, David Russell, DC, Stevan Walton, DC, and the Tom and Mae Bahan Library at Sherman College of Chiropractic for their assistance.

FUNDING SOURCES AND CONFLICTS OF INTEREST

The author received funding from the Association for Reorganizational Healing Practice and the International

Chiropractic Pediatric Association for writing this series of papers. No conflicts of interest were reported for this study.

CONTRIBUTORSHIP INFORMATION

Concept development (provided idea for the research): S.A.S.
Design (planned the methods to generate the results): S.A.S.
Supervision (provided oversight, responsible for organization and implementation, writing of the manuscript): S.A.S.
Data collection/processing (responsible for experiments, patient management, organization, or reporting data): S.A.S.
Analysis/interpretation (responsible for statistical analysis, evaluation, and presentation of the results): S.A.S.
Literature search (performed the literature search): S.A.S.
Writing (responsible for writing a substantive part of the manuscript): S.A.S.
Critical review (revised manuscript for intellectual content, this does not relate to spelling and grammar checking): S.A.S.

Practical Applications

- This series of articles provides an interpretation of the history and development of chiropractic vertebral subluxation theories.
- This series aims to assist modern chiropractors in interpreting the literature and develop new research plans.

REFERENCES

1. Faye LJ. *Motion Palpation of the Spine*. Huntington Beach, CA: Motion Palpation Institute; 1983.
2. Dishman R. Review of the literature supporting a scientific basis for the chiropractic subluxation complex. *J Manipulative Physiol Ther*. 1985;8(3):163-174.
3. Lantz C. The vertebral subluxation complex: part 1. *Chiropr Res J*. 1989;1(3):23-26.
4. Lantz C. The vertebral subluxation complex: part 2. *Chiropr Res J*. 1990;1(3):19-38.
5. Barge F. *Torticollis*. Davenport, IA: Bawden Bros.; 1979.
6. Barge F. *Scoliosis*. Davenport, IA: Bawden Bros.; 1981.
7. Barge F. *Tortipelvis: The Slipped Disc Syndrome: Its Cause and Correction*. Davenport, IA: Bawden Bros.; 1982.
8. Barge F. *Life Without Fear: Chiropractic's Major Philosophical Tenets*. vol. V. Eldredge, IA: Bawden Brothers, Inc.; 1987.
9. Barge F. *One Cause, One Cure: The Health & Life Philosophy of Chiropractic*. La Crosse, WI: La Crosse Graphics; 1990.
10. Gitelman R, Fitz-Ritson D. Somatovisceral reflexes. *ACA J Chiropr*. 1984;18(4):63-64.
11. Reinert O. Anatomical characteristics of subluxation: C2 through C7. *ACA J Chiropr*. 1984, May:62-69.
12. Reinert O. Sacro-iliac subluxation: the masked pretender? *ACA J Chiropr*. 1988, December:63-65.

13. Reinert O. Structural failure in the lumbar spine: a subluxation hypothesis. *Chiropr Tech*. 1993;5(1):62-69.
14. Grostic J. Dentate ligament: cord distortion hypothesis. *Chiropr Res J*. 1988;1(1):47-55.
15. Gatterman M. Indications for spinal manipulation in the treatment of back pain. *ACA J Chiropr*. 1982;19(10):51-52.
16. Luedtke K. Chiropractic definition goes to World Organization. *J Am Chiropr Assoc*. 1988;25(6):5,16.
17. *International Chiropractor's Association definition of subluxation*. Washington, DC: ICA; 1987.
18. Gatterman M. Development of chiropractic nomenclature through consensus. *J Manipulative Physiol Ther*. 1994;17(5):302-309.
19. Gatterman M. *Foundations of Chiropractic Subluxation*. St. Louis, MO: Mosby; 1995.
20. Chance M, Peters R. What's in a name? *Chiropr J Aust*. 1994;24(3):81.
21. Keating J. Notes on the Barge family. *Natl Inst Chiropr Res*. 204, Feb 23.
22. Stout R. The Ph.C. degree: an affirmation of chiropractic philosophy, 1908-1968. *Chiropr Hist*. 1988;8(1):11-12.
23. Palmer BJ. *The Science of Chiropractic: Eleven Physiological*. Vol. 2. Davenport, IA: Palmer School of Chiropractic; 1907.
24. Palmer BJ. *Philosophy of Chiropractic*. Vol. 5. Davenport, IA: Palmer School of Chiropractic; 1909.
25. Palmer BJ. *Our Masterpiece*. Vol. 39. Davenport, IA: Palmer School of Chiropractic; 1966.
26. Keating J, Callender A, Cleveland C. *A History of Chiropractic Education in North America*. Davenport, IA: Association for the History of Chiropractic; 1998.
27. Logan H. *Logan Basic Methods*. St. Louis, MO: Logan; 1950.
28. Walton S. *The Complete Chiropractor: RJ Watkins, DC, PhC, FICC, DACBR*. Asheville, NC: The Institute Chiropractic; 2017.
29. Kapandji IA. *The Physiology of the Joints: Annotated Diagrams of the Mechanics of the Human Joints*. London, England: E. & S. Livingstone; 1970.
30. Gatterman M. A patient-centered paradigm: a model for chiropractic education and research. *J Am Chiropr Med*. 1995;1(4):371-386.
31. Vernon H. The life and contribution of Dr. Ronald Gitelman: a pioneer of modern chiropractic science. *J Can Chiropr Assoc*. 2013;57(1):10.
32. Haldeman S. *Modern developments in the principles and practice of chiropractic*. New York: Appleton-Century-Crofts; 1980.
33. Gatterman MI, Vear HJ. Statutory determinants and curriculum development in chiropractic colleges in the absence of university affiliation. *J Can Chiropr Assoc*. 1992;36(4):222.
34. Smith O, Langworthy S, Paxson M. *A Textbook of Modernized Chiropractic*. Cedar Rapids, IA: American School of Chiropractic; 1906.
35. Howe J. Preliminary observations from cineroentgenological studies of the spinal column. *ACA J Chiropr*. 1970;IV(S-65-S-70).
36. Leach R. *The Chiropractic Theories: A Textbook of Scientific Research*. 4th ed. Lippincott Williams & Wilkins; 2004.
37. Leach R. The chiropractic theories: discussion of some important considerations. *ACA J Chiropr*. 1981;15(S19-S25).
38. Leach R. *The Chiropractic Theories: A Textbook of Scientific Research*. 3rd ed. Baltimore, MD: Williams and Wilkins; 1994.
39. Howe J. A contemporary perspective on chiropractic and the concept of subluxation. *ACA J Chiropr*. 1976;X(S-165-S-169).
40. Janse J. History of the development of chiropractic concepts: chiropractic terminology. In: Goldstein M, ed. *The Research Status of Spinal Manipulative Therapy: A Workshop Held at the National Institutes of Health, February 2-4, 1975*. Vol. 15. Bethesda, MD: U.S. Department of Health, Education, and Welfare; 1975:25-42.
41. Jessen A. The syndrome of leriche. *ACA J Chiropr*. 1973;VII(Jul):S-53-S-56.
42. Faye LJ. The subluxation complex. *J Chiropr Humanit*. 1999;9.
43. Moon D. The flight from the subluxation. *Upper Cervical Monogr*. 1980;2(8):1-2.
44. Gregory RR. A chiropractic dialogue. *Upper Cervical Monogr*. 1980;2(8):10-11.
45. Faye LJ. *Course Lecture Notes*. Huntington Beach, CA: Motion Palpation Institute; 1981.
46. Breig A. *Biomechanics of the Central Nervous System: Some Basic Normal and Pathologic Phenomena*. Almqvist & Wiksell; 1960.
47. Faye LJJ. John Faye articles: 1996-1999. *Dyn Chiropr*. 1999.
48. Redwood D. 21st century chiropractic principles and practice: interview with Leonard J. Faye, DC. *Health Insights Today*. 2009;2(6):1-4.
49. Watkins RJ. Subluxation terminology. *J Am Chiropr Assoc*. September 1968. In: Walton S. *The Complete Chiropractor: RJ Watkins, DC, PhC, FICC, DACBR*. Asheville, NC: The Institute Chiropractic; 2017:341-342.
50. Harper W. *Anything Can Cause Anything: A Correlation of Dr. Daniel David Palmer's Principles of Chiropractic*. 3rd ed. San Antonio, TX: William D. Harper; 1974.
51. Committee on Standardization of Chiropractic Principles. *ACA J Chiropr*. July 1965:27.
52. Watkins RJ. Don't miss the boat. In: Walton S. *The Complete Chiropractor: RJ Watkins, DC, PhC, FICC, DACBR*. Asheville, NC: The Institute Chiropractic; 2017:115-118.
53. Bittner H, Harper W, Homewood A, Janse J, Weiant C. Chiropractic of today. *ACA J Chiropr*. 1973;VII(S-82-S-88).
54. Palmer DD. *The Science, Art, and Philosophy of Chiropractic*. Portland, OR: Portland Printing House; 1910.
55. Faye LJ, Schafer R. *Motion palpation and chiropractic technic*. Huntington Beach, CA: The Motion Palpation Institute; 1990.
56. Schafer R. *Basic Chiropractic Procedure Manual*. Des Moines, IA: ACA; 1973.
57. Speransky A. *A Basis for the Theory of Medicine*. 2nd ed. New York, NY: International Publishers; 1943.
58. Suh CH. Biomechanical aspects of subluxation. In: Goldstein M, ed. *The Research Status of Spinal Manipulative Therapy: A Workshop Held at the National Institutes of Health, February 2-4, 1975*. Vol. 15. Bethesda, MD: U.S. Department of Health, Education, and Welfare; 1975:103-118.
59. Korr I. *The Collected Papers of Irvin M. Korr*. American Academy of Osteopathy; 1979.
60. Sato A. The somatosympathetic reflexes: their physiological clinical significance. In: Goldstein M, ed. *The Research Status of Spinal Manipulative Therapy: A Workshop Held at the National Institutes of Health, February 2-4, 1975*. Vol. 15. Bethesda, MD: U.S. Department of Health, Education, and Welfare; 1975:163-172.
61. Lantz C. Immobilization degeneration and the fixation hypothesis of chiropractic subluxation. *Chiropr Res J*. 1988;1(1):21-46.
62. Gatterman M. *Foundations of Chiropractic Subluxation*. 2nd ed. St. Louis, MO: Mosby; 2005.
63. Drain J. *Chiropractic Thoughts*. 2nd ed. Asheville, NC: The Institute Chiropractic; 2013.
64. Palmer BJ. *The Philosophy and Principles of Chiropractic Adjustments: A Series of Twenty-Four Lectures*. Vol. 3. 2nd ed. Davenport, IA: Palmer School of Chiropractic; 1911.
65. Patchen GH. The chiropractic idea: the new method of analyzing symptoms and adjusting the physical representative of the cause of disease. New York: Health Culture Club; March, 1907/1908.

66. ACA. Chiropractic terminology: a report of the ACA Council on Technic. *ACA J Chiropr.* October 1988;46-57.
67. Smallie P, Ratledge T. *Ratledge Philosophy*. Vol. 1. P. Smallie; 1979.
68. Loban J. *Technic and Practice of Chiropractic*. 2nd ed. Loban Publishing Company; 1915.
69. Triano J. The subluxation complex: outcome measurement of chiropractic diagnosis and treatment. *Chiropr Tech.* 1990;2(3).
70. Verner J. *The Science and Logic of Chiropractic*. 8th ed. Brooklyn, NY: Dr. P.J. Cerasoli; 1956.
71. Homewood AE. *The Neurodynamics of the Vertebral Subluxation*. 3rd ed. Wildwood, Canada: Homewood; 1981.
72. Muller RO. *Autonomics in Chiropractic: The Control of Autonomic Imbalance*. Toronto, Canada: The Chiro Publishing Company; 1954.
73. Peterson A, Watkins RJ, Himes H, College CMC. *Segmental Neuropathy: The First Evidence of Developing Pathology*. Canadian Memorial Chiropractic College; 1965.
74. Forster A. *Principles and Practice of Spinal Adjustment*. Chicago, IL: The National School of Chiropractic; 1915.
75. Firth J. *Chiropractic Symptomatology*. Vol. 7. Davenport, IA: Palmer College of Chiropractic; 1914.
76. Gregory AS. *Spinal Adjustment: An Auxillary Method of Treatment*. Oklahoma City, OK: Self-published;.
77. Carver W. *Carver's Chiropractic Analysis*. 2nd ed. Oklahoma City, OK: Chiropractic College; 1915.
78. Palmer BJ. *The Science of Chiropractic: Its Principles and Philosophies*. Vol. 2. Davenport, IA: Palmer School of Chiropractic; 1917.
79. Brantingham J. A review of some current and past literature regarding basic chiropractic hypotheses. *Dyn Chiropr.* 1984;2(8):6.
80. Brantingham J. A survey of literature regarding the behavior, pathology, etiology, and nomenclature of the chiropractic lesion. *ACA J Chiropr.* 1985;19(8):65-70.
81. Brantingham J. A critical look at the subluxation hypothesis. *J Manipulative Physiol Ther.* 1988;11(2):130-132.
82. Charlton K. Data and dogma: the use and abuse of information. *J Aust Chiropr Assoc.* 1987;17(2):46-48.
83. Charlton K. Approaches to the demonstration of vertebral subluxation: 1. introduction and manual diagnosis: a review. *Chiropr J Aust.* 1988;18.
84. Keating J, Nelson J, Mootz R. A model for clinical, scientific and educational development. *Res Forum.* 1986;2(4):103-104.
85. Hasselberg P. *Chiropractic in New Zealand: Report of a Commission of Inquiry*. Wellington, New Zealand: P.D. Hasselberg, Government Printer; 1979.
86. Sandoz R. Radiographic semiology of posterior vertebral arthroses. *Ann Swiss Chiropr Assoc.* 1969;4:107-154.
87. Watkins RJ. Subluxation terminology since 1746. *J CCA.* Fall 1968. In: Walton S. *The Complete Chiropractor: RJ Watkins, DC, PhC, FICC, DACBR*. Asheville, NC: The Institute Chiropractic; 2017:271-279.
88. Watkins RJ. Upper cervical mechanics. *J Clin Chiropr.* 1969;2(2). In: Walton S. *The Complete Chiropractor: RJ Watkins, DC, PhC, FICC, DACBR*. Asheville, NC: The Institute Chiropractic; 2017: 137-142.
89. Howe J. The role of x-ray findings in structural diagnosis. In: Goldstein M, ed. *The Research Status of Spinal Manipulative Therapy: A Workshop Held at the National Institutes of Health, February 2-4, 1975*. Vol. 15. Bethesda, MD: U.S. Department of Health, Education, and Welfare; 1975:239-247.
90. Kimberly PE. *Outline of Osteopathic Manipulative Procedures: The Kimberly Manual*. Kirksville, MO: Kirksville College of Osteopathic Medicine, Department of Osteopathic Manipulative Medicine; 1980.
91. Gillet H, Liekens M. *Belgium Chiropractic Research Notes*. 8th ed. 1970. Belgium.
92. Jamison J. Chiropractic and medical models of health care—a contemporary perspective. *J Manipulative Physiol Ther.* 1985;8(1):17-22.
93. Keating J, Young M. Who is the chiropractic scientific community. *J Aust Chiropr Assoc.* 1987;17(3):84-86.
94. De Boer K, Waagen G. The future role of the chiropractor in the health care system. *J Manipulative Physiol Ther.* 1986;9(3): 225.
95. Cassidy J, Potter G. Motion examination of the lumbar spine. *J Manipulative Physiol Ther.* 1979;2(3):151-158.
96. Wiles MR. Reproducibility and interexaminer correlation of motion palpation findings of the sacroiliac joints. *J Can Chiropr Assoc.* 1980;24(2):59.
97. Love RM, Brodeur R. Inter- and intra-examiner reliability of motion palpation for the thoracolumbar spine. *J Manipulative Physiol Ther.* 1987;10(1):1-4.
98. Deboer K, Harmon Jr R, Tuttle C, Wallace H. Reliability study of detection of somatic dysfunctions in the cervical spine. *J Manipulative Physiol Ther.* 1985;8(1):9-16.
99. Goldstein M. *The Research Status of Spinal Manipulative Therapy: A Workshop Held at the National Institutes of Health, February 2-4, 1975*. Vol. 15. Bethesda: U.S. Department of Health, Education, and Welfare; 1975.
100. Korr I. *The Neurobiologic Mechanisms in Manipulative Therapy*. Springer Science & Business Media; 1978.
101. Watkins RJ. Auricular proprioceptive postural reflex technic. *DCE.* 1992, December.
102. Rosenfield H. Planning for chiropractic's future. *ACA J Chiropr.* 1986;23(10):5.
103. Palmer DD, Palmer BJ. *The Science of Chiropractic*. Davenport, IA: The Palmer School of Chiropractic; 1906.
104. Leach R. *The Chiropractic Theories: A Synopsis of Scientific Research*. Mississippi State, MS: Mid-South Scientific Publishers; 1980.
105. Janse J, Houser RH, Wells BF. *Chiropractic Principles and Technic: For Use by Students and Practitioners*. 2nd ed. Chicago, IL: National College of Chiropractic; 1978.
106. Sinnott R. *The Greenbooks: A Collection of Timeless Chiropractic Works - by Those Who Lived It!* Mokena, IL: Chiropractic Books; 1997.
107. Faulkner F, Foley J, Senzon S. *Palmer Chiropractic Green Books: The Definitive Guide*. Asheville, NC: The Institute Chiropractic; 2018.
108. Palmer BJ. *The Philosophy, Science, and Art of Chiropractic Nerve Tracing: A Book of Four Sections*. Vol. 6. Davenport, IA: Palmer School of Chiropractic; 1911.
109. Palmer BJ. *The Philosophy and Principles of Chiropractic Adjustments: A Series of Thirty Eight Lectures*. Vol. 3. Davenport, IA: Palmer School of Chiropractic; 1908.
110. Palmer BJ. *The Subluxation Specific the Adjustment Specific*. Vol. 18. Davenport, IA: Palmer School of Chiropractic; 1934.
111. Forster A. *Principles and Practice of Chiropractic*. 3rd ed. Chicago, IL: The National Publishing Association; 1923.
112. Palmer DD. *The Chiropractor*. Los Angeles, CA: Press of Beacon Light Printing Company; 1914.
113. Faulkner T. *The Chiropractor's Protégé: The Untold Story of Oakley G. Smith's Journey with D.D. Palmer in Chiropractic's Founding Years*. Rock Island, IL: Association for the History of Chiropractic; 2017.
114. Davis AP. *Neuropathy: The New Science of Drugless Healing Amply Illustrated and Explained Embracing Ophthalmology, Osteopathy, Chiropractic Science, Suggestive Therapeutics, Magnetics, Instructions on Diet, Deep Breathing, Bathing Etc.* Cincinnati, OH: F.L. Rowe; 1909.

115. Carver W. *Carver's Chiropractic Analysis of Chiropractic Principles: As Applied to Pathology, Relatology, Symptomology and Diagnosis*. East Aurora, NY: Carver; 1922.
116. Swanberg H. *The Intervertebral Foramina in Man; The Morphology of the Intervertebral Foramina in Man, Including a Description of Their Contents and Adjacent Parts, With Special Reference to the Nervous Structures*. Chicago, IL: Chicago Scientific Publishing Co.; 1915.
117. Cramer G, Scott C, Tuck N. The holey spine: a summary of the history of scientific investigation of the intervertebral foramina. *Chiropr Hist*. 1998;18(2):13-24.
118. Bovine GDD. Palmer's adjustive technique for the posterior apical prominence: "Hit the High Places". *Chiropr Hist*. 2014;34(1):7-19.
119. Gaucher-Peslherbe P. *Chiropractic: Early Concepts in Their Historical Setting*. Chicago, IL: National College of Chiropractic; 1993.
120. Gaucher-Peslherbe P. DD Palmer as authentic medical radical. *J Neuromusculoskeletal Syst*. 1995;3(4):175-181.
121. Lantz C. A critical look at the subluxation hypothesis: to the editor. *J Manipulative Physiol Ther*. 1990;13(1):42.
122. Keating J. A critical look at the subluxation hypothesis: to the editor. *J Manipulative Physiol Ther*. 1990;13(6):350-351.
123. Brantingham J. In reply. *J Manipulative Physiol Ther*. 1989;12(2):154.
124. Lantz C. A critical look at the subluxation hypothesis: to the editor. *J Manipulative Physiol Ther*. 1989;12(2):152-154.
125. Boone W, Dobson G. A proposed vertebral subluxation model reflecting traditional concepts and recent advances in health and science. *J Vert Sublux Res*. 1996;1:19-36.
126. Owens E, Pennacchio V. Operational definitions of vertebral subluxation: a case study. *Top Clin Chiropr*. 2001;8(1):40-49.
127. Nelson C. The subluxation question. *J Chiropr Humanit*. 1997;7:46-55.
128. Toward a Keating J. *Philosophy of the Science of Chiropractic: A Primer for Clinicians*. Stockton, CA: Stockton Foundation for Chiropractic Research; 1992.
129. Boline P, Keating J, Brist J, Denver G. Interexaminer reliability of palpatory evaluations of the lumbar spine. *Am J Chiropr Med*. 1988;1(1):5-11.
130. Keating J. Science and politics and the subluxation. *Am J Chiropr Med*. 1988;1(3):107-110.
131. Mootz R, Keating Jr J, Kontz H, Milus T, Jacobs G. Intra- and interobserver reliability of passive motion palpation of the lumbar spine. *J Manipulative Physiol Ther*. 1989;12(6):440-445.
132. Keating J. To hunt the subluxation: clinical research considerations. *J Man. Phys Ther*. 1996;19(9):613-619.
133. Keating J, Charton K, Grod J, Perle S, Sikorski D, Winterstein J. Subluxation: dogma or science. *Chiropr Osteopat*. 2005;13(17):1-10.
134. Murphy D, Schneider M, Seaman D, Perle S, Nelson C. How can chiropractic become a respected mainstream profession? The example of podiatry. *Chiropr Osteopat*. 2008;16(10):1-9.
135. Holt K, Russell D, Hoffmann N, Bruce B, Bushell P, Haavik H. Interexaminer reliability of a leg length analysis procedure among novice and experienced practitioners. *J Manipulative Physiol Ther*. 2009;32(3):216-222.
136. Chapman-Smith D. Professional notes: interexaminer reliability - leg length analysis. *Chiropr Rep*. 2009;23(4).
137. Cooperstein R, Haneline M, Young M. Interexaminer reliability of thoracic motion palpation using confidence ratings and continuous analysis. *J Chiropr Med*. 2010;9(3):99-106.
138. Cooperstein R, Gleberzon B. *Technique Systems in Chiropractic*. Philadelphia, PA: Churchill Livingstone; 2004.
139. Cooperstein R, Young M, Haneline M. Interexaminer reliability of cervical motion palpation using continuous measures and rater confidence levels. *J Can Chiropr Assoc*. 2013;57(2):156-164.
140. Holt K, Russell D, Cooperstein R, Young K, Sherson M, Haavik H. Inter-examiner reliability of the detection of vertebral subluxations using continuous measures and confidence levels. *J Chiropr Educ*. 2016;30:59.
141. Holt K, Russell D, Cooperstein R, Young M, Sherson M, Haavik H. Interexaminer reliability of seated motion palpation in defined spinal regions for the stiffest spinal site using continuous measures analysis. *J Manipulative Physiol Ther*. 2018;41(7):571-579.
142. Holt K, Russell D, Cooperstein R, Young M, Sherson M, Haavik H. Interexaminer reliability of a multidimensional battery of tests used to assess for vertebral subluxation. *Chiro J Aust*. 2018;46(1):100-117.
143. Bergmann T, Peterson D. *Chiropractic Technique: Principles and Procedures*. 3rd ed. St. Louis, MO: Elsevier; 2011.



The Chiropractic Vertebral Subluxation

Part 10: Integrative and Critical Literature

From 1996 and 1997

Simon A. Senzon, MA, DC

ABSTRACT

Objective: The purpose of this paper is to review and discuss the history of chiropractic vertebral subluxation (CVS) during 1996 and 1997. The literature during this period offered critical and integrative models emphasized by a need for research into operational and functional definitions.

Discussion: Several integrative approaches emerged, from Rome's 296 synonyms to Bergman's Pain/Tenderness, Asymmetry/Alignment, Range of Motion Abnormality, Tissue Tone, Texture, Temperature Abnormality, and Special Tests (PARTS) analysis adopted by the profession in the United States. Other noteworthy contributions included Ruch's *Atlas of Common Subluxations*, Epstein's introduction of network spinal analysis, and Kent's review of CVS models. Boone's introduction of the *Journal of Vertebral Subluxation Research* was accompanied by his 3-part model with Dobson. These years also included the paradigm statement of the Association of Chiropractic Colleges, which was adopted by the American Chiropractic Association, International Chiropractors Association, and World Federation of Chiropractic. Two other papers included Nelson's critique of the CVS paradigm and Keating's 1996 "Hunt for the Subluxation."

Conclusion: The CVS reached a new stage of complexity and critique and offered new directions for research, integration, and development. (J Chiropr Humanit 2018;25C:146-168)

Key Indexing Terms: *Chiropractic; History*

INTRODUCTION

The theories of chiropractic vertebral subluxation (CVS) may have reached an apogee in the literature between 1996 and 1997. Several streams of discourse from preceding decades were captured in articles focused on criticism,¹ terminology,² integration,³ consensus,⁴ new vertebral models,⁵⁻⁷ assessment procedures,⁸ reviews of models,⁹ and calls for various levels of research to study CVS.^{7,10,11}

Events in chiropractic history are highlighted in this paper because of their relevance to CVS. The first was the trend to develop consensus statements that continued during this period.^{12,13} In 1996, the presidents of the chiropractic colleges in North America agreed to a definition of CVS,⁴ which was endorsed by several national and international organizations.¹⁴ During this period an "atlas of subluxations" was published, and develops a new

perspective from the long tradition of dissection in chiropractic subluxation research.¹⁵⁻²⁰ Also, an assessment protocol became the methodology for CVS detection accepted by Medicare.^{8,21,22} Debates in the profession about the lexicon continued during these years. As well, during this short period, increased calls were heard for research to include validity studies and reliability studies in chiropractic.¹⁰ Keating also called for an operational definition for chiropractic,¹⁰ which was answered by Owens, Boone, and Dobson.^{5-7,23}

During this time, the *Journal of Vertebral Subluxation Research (JVSR)* was developed originally to publish papers dedicated to research, theory, and models of CVS.²⁴ The *JVSR* was sponsored by the Council on Chiropractic Practice,²⁵ which was developing evidence-based guidelines for chiropractic during that time.²⁶ The *JVSR* was an outgrowth of that process and represented a school of thought, which was outside of the academic mainstream in chiropractic during this period.²⁷ It is possible that limited distribution, in addition to social and political forces within the profession, kept the wider profession from evaluating the articles in the journal on their own merits. The first 3 issues of the *JVSR* included Boone and Dobson's *Vertebral Subluxation Model (VSM)*; Kent's review of subluxation models; and Epstein's first peer-reviewed article, "Network Spinal Analysis: A System of Health Care Delivery Within the

School of Health and Human Sciences, Southern Cross University, Lismore, New South Wales, Australia.

Corresponding author: Simon A. Senzon, MA, DC, 218 E Chestnut Street, Asheville, NC 28801. Tel: +1 828 251 0815.

(e-mail: Simon@institutechiro.com).

Paper submitted May 18, 2016; accepted May 15, 2018.
1556-3499

Copyright © 2018 by National University of Health Sciences.
<https://doi.org/10.1016/j.echu.2018.10.008>

Subluxation-based Chiropractic Model.”^{3,5-7,9} These articles represent at least 4 different streams of the CVS literature and contribute to the context of this period. Boone and Dobson’s articles followed the trends to describe CVS as complex and proposed new research strategies for the profession.⁵⁻⁷ Kent’s article reviewed the current literature,⁹ and Epstein’s article demonstrated a practical integration of models and theories and was the culmination of more than a decade of clinical and theoretical development.^{3,28}

The purpose of this paper is to review and discuss CVS in chiropractic just before the turn of the century. The goal is to capture the culmination of a century of debate, consensus, and theory development on CVS (Fig 1). This paper aims to offer insights into the context of the period’s models, critiques, debates, and reviews.

DISCUSSION

Consensus and Terminology

Three important publications in the literature during this period include the consensus statement by the Association of Chiropractic Colleges (ACC)⁴; Rome’s paper on CVS terminology²; and the Pain/Tenderness, Asymmetry/Alignment, Range of Motion Abnormality, Tissue Tone, Texture, Temperature Abnormality, and Special Tests (PARTS) method for CVS assessment and documentation.⁸

ACC Consensus (1996). The ACC was formed in 1985 from an association of college presidents. In March 1994, an expanded ACC Educational Conference was held in Las Vegas, Nevada. The meeting led to a consensus statement published in July 1996, as part of the ACC Chiropractic Paradigm. The paradigm was signed by all college presidents and adopted by several organizations, including the International Chiropractic Association, American Chi-

ropractic Association (ACA), and World Federation of Chiropractic. On May 23, 2001, at the World Federation of Chiropractic Congress in Paris, the ACC Paradigm was approved by the assembly.²⁹

The ACC definition stated, “A subluxation is a complex of functional or structural or pathological articular changes that compromise neural integrity and may influence organ system function and general health.”⁴ The definition captured the views based on the previous decades of research, model building, and theory in the literature. It was not designed as an operational definition to be tested, but as a consensus that could unify the many factions in the profession.

In a 4-part paradigm statement, part 4 reads:

Chiropractic is concerned with the preservation and restoration of health, and focuses particular attention on the subluxation. A subluxation is a complex of functional and/or structural and/or pathological articular changes that compromise neural integrity and may influence organ system function and general health. A subluxation is evaluated, diagnosed, and managed through the use of chiropractic procedures based on the best available rational and empirical evidence.⁴

The ACC paradigm statement might be viewed as the latest in a long line of consensus statements on CVS dating back to 1966³⁰ and 1905.³¹

Rome’s Synonyms (1996). Peter Rome, an Australian chiropractor who graduated from Canadian Memorial Chiropractic College in 1969, published a literature review on as many CVS terms as he could catalog.² He eventually had a list of 296 terms from 1688 to 1996 and onward. The paper captured much of the chiropractic literature to date.²

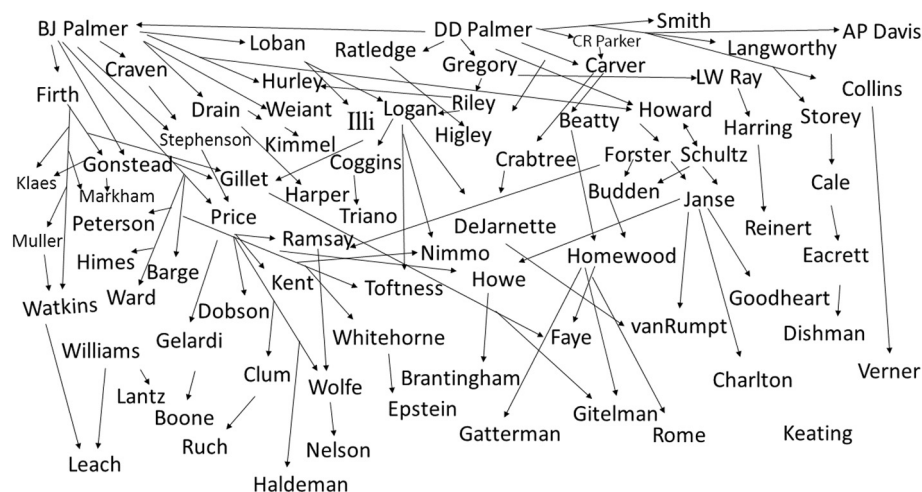


Fig 1. Teacher-student relationships of subluxation theorists starting with D. D. Palmer.



Fig 2. *Peter Rome.*

Rome came up with more than 500 terms since publication of the paper (Fig 2).^{32,33}

Rome offered 5 reasons for why chiropractors and other professions including the medical profession continue to come up with new words for subluxation, which included the need to create a new term, conflicts as to how the term should be defined, a lack of acceptance and understanding of the term, a need to build a bridge between the chiropractic definitions and medical definitions, and the semantic problem that the term *subluxation* already had a definition when chiropractors adopted it and gave it a new definition (Fig 3).² He wrote, “It is accepted that there is a defined scientific difference between a ‘medical subluxation’ and a ‘chiropractic subluxation.’”² Rome then described issues such as politics and communication surrounding terminology, and changing well-worn terminology. Rome explored the recent literature from Faye and Dishman’s subluxation complex to Gatterman’s subluxation syndrome,³⁴⁻³⁶ to Brantingham’s somatic dysfunction,³⁷ and to Leach’s segmental dysfunction and chronic neural dysfunction,³⁸ which included facilitation.

Rome argued that the disadvantage of trying to define new terms rather than retain an identifying term was detrimental to the profession’s identity.² He wrote:

Why create ambiguity by altering an established definition in the first place? Why confuse a reasonably well understood term? The effect of any major change can only dilute the identity of the chiropractic profession by questioning the very concept that it has been expounding for 100 years.²

He concluded that the term should be qualified but not discarded, as its historical use is rich for biology, clinical practice, and the history of the profession.² He suggested that there should be clarification between the term vertebral subluxation complex (VSC) for spinal dysfunction and subluxation complex for “articular derangements of the extremities.”² He also suggested there should be an explanation and dissemination of a broad and clear definition of the terms to other professions, publishers, medical dictionaries, journals, colleges, and associations.

Bergmann’s PARTS (1997). In 1998, the ACA coordinated a consensus panel to develop guidelines for CVS diagnosis without the need for x-ray analysis²¹ and to adequately document chiropractic services for Medicare as outlined in the Balanced Budget Act of 1997. The panel adopted Bergmann’s PARTS criteria, which included technique-specific tests.⁸ The ACA panel adopted PART, not PARTS.²¹ Medicare guidelines required 2 of the 4 PART criteria, 1 of which must be changes to asymmetry and alignment or abnormal range of motion.²¹

Bergmann and colleagues authored a textbook that included the PARTS concept. The book arose from the intercollegiate conferences around chiropractic technique,³⁹⁻⁴¹ which were linked to older conferences about the neurobiologic mechanisms of spinal manipulative therapy.^{12,41,42} For example, at the 1977 workshop that followed the 1975 National Institute of Neurological Disorders and Stroke conference, Greenman,

Rome’s 5 Reasons Chiropractors Comes up with new terms (quoted)	
1. The chiropractic definition of a subluxation (vertebral subluxation, vertebral subluxation complex), with its many components, is not generally accepted, acknowledged, or understood.	
2. Authors feel they can improve on the understanding or acceptance of terms between medical and chiropractic versions or interpretations.	
3. The word and usage clashes with the traditionally understood use of the word and authors wish to clarify a semantic problem.	
4. Authors wish to feel they have invented a new word, if only to fit their descriptive paper.	
5. A lack of semantic agreement as to what meanings a term actually encompasses	

Fig 3. *Rome’s 5 reasons for why chiropractors come up with new terminology.*

from the College of Osteopathic Medicine at Michigan State University, wrote, “The three diagnostic findings of somatic dysfunction are (1) asymmetry, (2) restricted motion, and (3) tissue texture abnormality.”⁴³ His description of tissue texture is similar to previous chiropractic approaches to palpation and instrumentation.^{44,45} Bergmann’s analysis can be linked to osteopathic diagnostic procedures and chiropractic literature on clinical and empirical analysis.

Keating’s Influence on Discourse

Keating’s influential article “To Hunt the Subluxation”¹⁰ was published in 1996 and summed up his viewpoint by defining types of validity tests.¹⁰ The paper reflects his ideas and is still cited in the literature.^{1,10,46-52} Keating’s arguments from the article laid the foundation for subsequent publications that are often cited in calls to dismiss the term *subluxation* from the chiropractic literature.^{47,52-54} By reviewing a chronology of Keating’s writings, we may more fully understand the perspective that he brought to his writings on chiropractic and better assess his work and impact.

Between 1984 and 1996, Keating published at least 25 articles on chiropractic.^{10,55-79} Keating’s first call for an operational definition for CVS came in the 1980s,⁵⁹ followed by several papers and a textbook exploring the epistemological rationale for his position and mapping out several areas of potential research for the profession.^{10,67,70} In 1990, Keating wrote:

But let us not continue to mistake private empirical support (even when recognized by governmental bodies, such as the NZC) nor basic science rationale (even when well referenced) for clinical research validation. Let us not confuse “science consistency” with scientific evidence of the effectiveness of a treatment, nor with scientific validation of a hypothetical construct (such as vertebral subluxation complex). The proof of the pudding in an applied discipline is the scientifically demonstrated utility of its theories and methods, and in that respect we are very much nearer the beginning than the end of our journey. There is great room for dialogue and debate.⁸⁰

Keating’s references in this statement are to the Royal New Zealand Commission (NZC) Report and Kaminski’s proposed evaluation procedures for chiropractic practices.^{81,82} He argued for several levels of validity studies throughout his career.^{10,70}

Keating’s Background and First Roles in Chiropractic. Keating completed his PhD in clinical psychology from the State University of New York (SUNY) at Albany in 1981. His dissertation was a behavioral approach to nocturnal enuresis written when Behaviorism was at the end of its dominance in psychology.^{83,84} After completing a residency, Keating taught as an adjunct professor at the Behavioral Medicine Clinic in the department of psychology at the University of

the Pacific in Stockton, California.⁸⁵ During that time, he was hired by Don Smallie to do research for the Stockton Foundation for Chiropractic Research.^{55,86} Smallie introduced Keating to Miller, the president of Palmer College of Chiropractic West (PCCW).⁸⁶ Keating was hired by PCCW in 1983 and was soon head of the research department. He eventually taught at several chiropractic colleges. Keating died on October 14, 2007 (Fig 4).⁸⁷

Keating and Mootz (1986-1989). Keating’s first review articles on chiropractic and CVS were coauthored with Robert Mootz, a 1980 Palmer College of Chiropractic (PCC) graduate who started working at PCCW in 1985 and later became dean.^{88,89} They collaborated on several papers in the late 1980s,^{60,61,66} some of which should be explored primarily in articles on philosophy and scope of practice and included discussion related to politics, medicine, and research. It seems that many of the arguments in these early writings formed the foundation for Keating’s later works.

In 1986, Keating, Mootz, and Jim Nelson presented a model of clinical, scientific, and educational development at the Palmer Research Forum.⁶⁰ They suggested that research in chiropractic was limited for several interlocking reasons. They proposed that the limitations were related to political struggle, medical ostracism, and “lack of funds for research, anti-scientific components of the philosophy, isolation from the scientific community, lack of university based chiropractic colleges, isolation from hospitals and other healthcare providers, lack of understanding of



Fig 4. Joseph Keating.

research methods, and lack of practitioner-scientist role-models.”⁸⁸ They developed a chart to depict the “pattern of inter-locking impediments to the development of chiropractic science” (Fig 5).⁸⁸ In these articles, Keating and Mootz seemed to be guided by David Barlow’s scientist-practitioner paradigm.⁹⁰ Barlow was a psychology professor at State University of New York, and it is suspected he may have been one of Keating’s professors.⁹¹

In 1989, Keating and Mootz described the values of clinician-scientists that should be instilled into the profession as a way to develop a “research consciousness.”⁶⁶ They suggested that such a consciousness should be promoted through dialogue with the leadership of associations, colleges, and technique organizations. They proposed it could then spread to the colleges. They recommend an open-minded caution in relation to new ideas and claims for efficacy as well as counsel to the future scientists, to be wary of the perceived public relations threat they may pose to political medicine and the “traditionalists” within the profession.⁶⁶

Keating and Mootz acknowledged the importance of model building and the understanding of CVS mechanisms to the future evolution of chiropractic, and they emphasized clinical research to evaluate chiropractic’s usefulness.⁶⁶ They stated that clinical trials should become a priority with a focus on placebo, neural circuitry, biomechanics, kinesiology, and prognostic indicators. However, they also emphasized that research was secondary to the promotion of health. Two examples they give are the lack of research on analgesic medications and hypnosis. Even though the mechanisms were not fully understood, both were recommended to patients.⁶⁶

Keating and Mootz recognized that clinical trials would be difficult and costly for chiropractors, and so they proposed single-subject and small-group research designs. Each practitioner could do a clinical “trial of one” and critically evaluate the literature by replicating data trials and thereby add to the literature. They suggested that “Each new patient becomes the

focus of a potentially new theory.”⁶⁶ Carefully controlled case studies could produce “field based descriptive clinical report(s).”⁶⁶ Their emphasis on well-designed case studies followed a similar recommendation made by Keating and Miller about the importance of case studies.⁵⁹

Keating and Mootz suggested, based on the historical record, defensive dogmatism developed in chiropractic from the pressures from political medicine, accounted for much of the infighting within chiropractic. They concluded that rigidly adhering to theories that are untested equates to “dogma” and that dogmatic thinking has hindered scientific development in chiropractic.⁶⁶

Keating’s Writings (1986-1995). In 1986, Keating initiated calls for an operational definition for CVS that were renewed throughout his writings.^{59,67,70} An operational definition could be used in randomized trials, placebo-controlled clinical trials, and other research designs. In 1992, Keating acknowledged that most of the chiropractic profession relied on CVS, but he did so by saying the “straights” believe in “subluxation” and the “mixers” believe in “spinal lesion.”⁷² He wrote, “Straight chiropractors have traditionally adhered to an unswerving belief in the meaningfulness of subluxation as a clinical entity... the mixer community, an unswerving belief in the significance of the chiropractic lesion.”⁷² Keating did not make the point that most of the leaders from the “mixer” side of the profession were CVS theorists and most of the profession was using the term *subluxation*, even though some were calling for new terminology and a new focus for the profession.^{12,13,37,92-101}

Keating concluded that CVS had questionable validity, was tentative, and was largely an untested hypothesis. He suggested that scientific development was impossible if CVS was defined as an “intrinsically deleterious clinical finding,”⁷² if symptoms were not used as a primary factor in its detection.⁷²

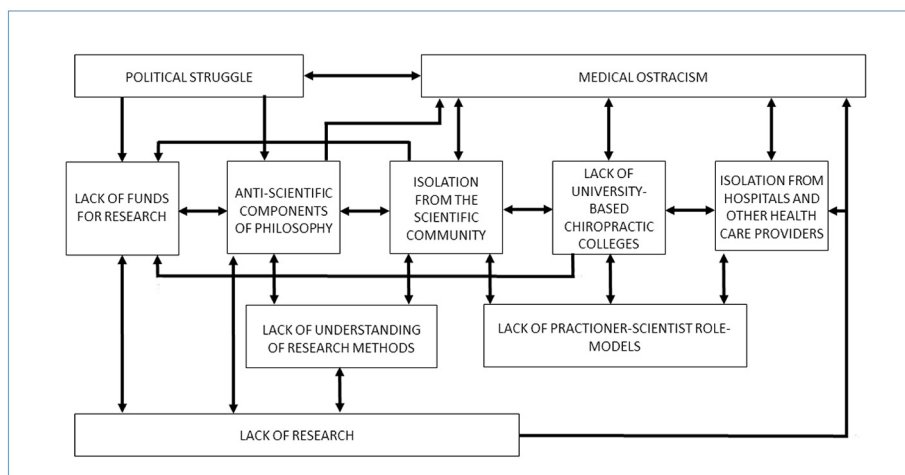


Fig 5. Redrawn from a replication of the original diagram from Mootz, Keating, and Nelson.

Keating summed up his ideas in his book *Toward a Philosophy of the Science of Chiropractic: A Primer for Clinicians*.⁷⁰ It is a thorough book in chiropractic on research design, philosophy, and the philosophy of science. It was published by the Stockton Foundation for Chiropractic Research. Keating built upon the scientist-practitioner paradigm and developed several detailed critiques and suggestions for the profession's research agenda to move forward.⁷⁰

Keating's "To Hunt the Subluxation" (1996). Keating's 1996 article "To Hunt the Subluxation: Clinical Research Considerations"¹⁰ has been cited 18 times in the indexed literature, according to Google Scholar, and 21 times in the *Cumulative Index to Nursing & Allied Health Literature* database.¹⁰² Two documents that reference this paper include Nelson's 1997 article and the preface to the fourth edition of Leach's book, published in 2004.^{1,46} Both have been cited in papers, according to Google Scholar.¹⁰² This paper is also cited by Keating, Charlton, Grod, Perle, Sikorski, and Winterstein in "Subluxation: Dogma or Science?" to support this statement: "there is today no scientific 'gold standard' for detecting these reputedly ubiquitous and supposedly significant clinical entities."⁴⁷ For this statement to be accurate, the references for the 1996 article would need to be comprehensive enough to support that claim; however, I suggest that they are not.¹⁰ Most references in the body of the paper point to reliability studies.¹⁰³⁻¹⁰⁸ Based on these references, Keating claimed there is no hard evidence for the validity of an operational definition for CVS.¹⁰ He argued that chiropractic researchers have not established a relationship between CVS and health problems and that "the validity of the chiropractor's 'subluxation complex' has not been studied by chiropractors or anyone else."¹⁰ Keating further stated that there was no standard to compare CVS detection methodologies.

Keating's call for an operational definition is an important contribution to the literature. An operational definition of CVS that could meet the rigorous demands of the scientific method around many types of research questions was needed.¹⁰ To address this issue, he proposed several types of research questions involving inter and intraexaminer reliability, concurrent validity, predictive validity, discriminant validity, and trial validity, and challenged the profession to operationalize CVS and begin to conduct validity research.¹⁰

Critique and Development of Theories

In 1997, Nelson published a critique on CVS and William Ruch an atlas.^{1,15} Nelson's critique built on previous arguments to do away with *subluxation* as a term and emphasized the need for an operational definition. Ruch's atlas bolstered previous models by establishing a new level of anatomical data to expand on CVS criteria.

Nelson's Critique (1997). Craig Nelson graduated from Northwestern Chiropractic College in 1974 and was a former instructor there. In 1997, Nelson wrote a critique of

Gatterman's book,³⁶ with some suggestions for future research.¹ Nelson's references included chapters from Gatterman's book,³⁶ Faye's notes,¹⁰⁹ papers by Lantz,¹¹⁰ the ACC paradigm,⁴ and Keating's 1996 article.¹⁰ Most of the paper consisted of Nelson's opinions and generalizations about the dichotomy in chiropractic around CVS along with some insightful suggestions for testing hypotheses.¹ The article explored the limitations of model building and the need for operational definitions. It is in part an attempt to discredit the extensive consensus processes that led up to Gatterman's book and the ACC paradigm.^{1,4,36}

Nelson criticized the semantic approach to deciding upon subluxation terminology and suggested that all of the models of the VSC are a tautology. He did not think that CVS should be described as more than one thing and certainly not as a complexity of many components or in terms of syndromes.¹ Nelson's critique pointed to the need for strong theory building and hypothesis testing. He noted the need for the literature in the chiropractic profession to demonstrate the differences between hypothesis and theory, and how to test them.

Nelson suggested that any theory should "bear some resemblance to its historical antecedents."¹ Further, he wrote, "Unless the profession is willing to declare that D. D. Palmer's ideas have no current relevancy, any subluxation theory should retain some connection to Palmer's formulation of subluxations. Otherwise, it's more appropriate and honest to simply abandon the term."

However, Nelson did not cite the current theories, which were built upon the models and research of Verner,¹¹¹ Homewood,⁴⁴ Watkins,³⁰ and Harper.¹¹² All of those theorists cited D. D. Palmer and integrated his theories into their models.¹¹³ The paper did not contain this historical context. A similar critique of Nelson's paper was written by Faye, who acknowledged that his own definition of the VSC in 1967 was inspired by the consensus definitions published in the *Journal of the ACA* in the 1960s.¹¹⁴

Ruch's Atlas of Common Subluxations of the Human Spine and Pelvis (1997). William Ruch graduated from Life Chiropractic College West in 1986 (Fig 6). Ruch dissected over 250 cadavers while teaching in the human spinal dissection laboratory at Life Chiropractic College West from 1987 to 1993. He has worked in the anatomy department as an adjunct faculty since 1997.¹¹⁵ Ruch's photo atlas was based on his dissection research.¹⁵ The second edition was published in 2014.¹⁵

The atlas viewed CVS from the perspective of degeneration by including photographs, x-ray imaging, computed tomography scans, and magnetic resonance imaging. Ruch proposed that the degenerative process owing to changes in alignment of the spine leads to impaired blood and cerebral spinal fluid dynamics; pain; loss of neurological control; and alterations of the cord, brainstem, and central nervous system (CNS). The emphasis of the book is on the normal biomechanics of the CNS and how movements of the spine, cord, and



Fig 6. William J. Ruch. With permission from Life Chiropractic College West.

associated tissues are affected by CVS. To help explain his extensive observational images, Ruch relied on the literature on spine and cord dynamics.^{15,116}

Ruch's *Atlas* was written following the chiropractic tradition that started with D. D. Palmer's osteological lab,¹¹⁷ Swanberg's work inspired by Smith,^{17,118} Forster's early dissection research to define subluxation,¹¹⁹ Janse and Illi's study of the lumbar and pelvis,^{19,120} and Winterstein and Bachop's intervertebral foramen studies.²⁰ Ruch developed a complex view of CVS that furthered the paradigm, integrating Breig's biomechanics of the spinal cord and CVS.^{15,116,121-124}

Epstein's Integrative Approach

In 1996, Donald Epstein published his model and protocols related to his network spinal analysis (NSA).³ Epstein referred to his approach with the term *network*, because it was his attempt to include a wide variety of models, theories, and techniques; to capture the idea of a distributed network; and to include Pert's theory of a somatopsychic network, which included her observation of high concentrations of neuropeptides in the dorsal horn of the spinal cord.¹²⁵⁻¹²⁷ Since 1996, Epstein has continued to develop his theory and methods.^{128,129}

Epstein graduated from New York Chiropractic College in 1977, during which time Napolitano (a Palmer graduate) was president (Fig 7).⁸⁸ In 1983, Epstein taught and published articles on his NSA.^{124,130-134} Between 1989 and 1996, Epstein's model and clinical protocols evolved.^{126,127,135-140}

In 1983, Epstein described using instrumentation, which included classic paraspinal thermal pattern work from the Palmer school, leg checks, and palpation. His intention was to develop an analysis that could be used with any chiropractic technique.¹³⁰ Central to his analysis was the differentiation between what he termed class A or *structural subluxations* and class B or *meningeal subluxations*, which he later termed the *facilitated subluxation*. He proposed that class A comprised

primarily of fixations and meningeal subluxations because of more complex neurological phenomenon usually related to chemical and emotional etiology. He linked class B to B. J. Palmer's concepts of torqued meningeal occlusion and multiple cord pressures by tension.¹⁴¹

Epstein related the class B functionally to Speransky's neurodystrophic process,¹⁴² physiologically to a global CNS response affecting cerebrospinal fluid transport and circulation, and biomechanically to the meninges.¹³² He hypothesized that the CNS response involved referred tension patterns throughout the spinal and meningeal system, which may relate to areas of pain and altered movement to "the major site of neurological insult"¹²⁴ (Fig 8).³

Network Chiropractic Analysis was a combination of reflex techniques such as Logan and Sacro-Occipital Technique,^{143,144} full-spine structural techniques such as Pierce-Stillwagon,¹⁴⁵ and upper cervical techniques.¹⁴⁶ It was thought that analysis had to do with sequence and force application in relationship to facilitation, dystrophic processes, and reflex patterns.^{3,35,147}

Epstein believed that the meningeal subluxation caused a tension on both ends of the spine, which he thought could fluctuate from one end to the other.¹²⁴ He based this thought in part on Toftness' incorporation of D. D. Palmer's theory that the neuroskeleton is a tonal regulator of the tension frame.¹⁴⁸ Toftness believed that CVS moved through the frame as a type of stress response.¹⁴⁹ Epstein hypothesized that an area of critical tension could be determined.¹³²

Thomas Faulkner wrote a letter to Epstein suggesting that he should include the works of Breig and Lowell



Fig 7. Donald Epstein.

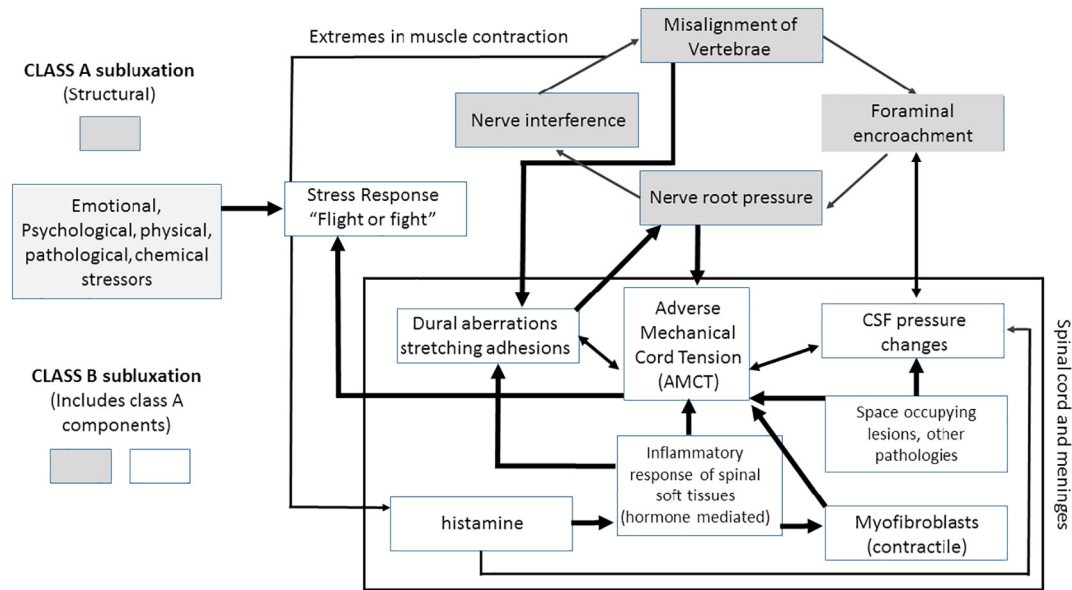


Fig 8. Redrawn from the original, this demonstrates relationships between class A and class B subluxations.

Ward:¹⁵⁰ “I found your article regarding meningeal anatomy most interesting. I further commend you on your excellent anatomical exactness and thorough documentation of your report by listing medical references.”¹⁵¹ Epstein later included Breig and Ward in his expanded writings, now referred to as *Spinal Meningeal Functional Unit*.¹⁵⁴

Epstein described his theory in relation to the postural response to stress and how the meningeal tension was related to the central nervous stress response.¹³⁴ This developed from Ward's *Spinal-Column-Pelvic-Meningeal-Unit*,¹²³ Breig's pons-cord tract dynamics,¹⁵² and several other neurological models from the Russian neurophysiology literature.¹⁵³ In 1987, he expanded on his theory by integrating Homewood's dynamic subluxation model⁴⁴ with Seyle's stress cascade,¹⁵³ Korr's facilitation hypothesis,¹⁵⁴ and Travell's trigger point model.¹⁵⁵

In 1989, Epstein was a speaker at the Academy for Research in the Chiropractic Sciences International symposium on Chiropractic Measurement and Methodologies for the 21st Century. The Academy for Research in the Chiropractic Sciences International was organized by several leading technic developers, such as Stillwagon, Toftness, Ward, Sweat, and Pettibon. This presentation integrated his analysis with the theories of Speransky,¹⁴² Ukthomsky,¹⁵³ and Seyle in relation to palpation for pathologically dominant patterns in the CNS.^{135,156}

By 1996, Epstein developed his analysis into a 5-phase model of CVS patterns layered into 3 levels of care.³ The phasing system of analysis was based in part on Grof's theory of condensed experiences embedded as memory in the neurophysiology,^{157,158} tensegrity models of tension

dissipation,¹⁵⁹ Coggins interpretation of Logan Basic,¹⁴³ Pierce-Stillwagon's spinal analysis, Ward's stressology,¹²³ B. J. Palmer's perspective, and D. D. Palmer's theory of the neuroskeleton.^{127,148} The proposed system included a sequential approach to the CVS patterns.¹²⁷ From this period of Epstein's work, empirical studies of the spinal wave associated with NSA protocols and qualitative research on recipients of NSA care were attempted. These studies led to models of emergent health-related quality of life, wellness outcomes, and a reorganizational healing paradigm.¹⁶⁰⁻¹⁶⁷

The spinal wave behavior associated with NSA has been studied from 1997 until 2015¹⁶⁸ at University of Southern California and other universities by engineers looking at the mathematical characteristics of the surface electromyography signals at 4 levels of the spine: sacrum, lumbar, thoracic, and cervical.^{31,128} Several papers,¹⁶⁹⁻¹⁷¹ conference presentations,¹⁷²⁻¹⁷⁵ and a dissertation have explored its features.¹⁷⁶ It is proposed that the spinal wave associated with network care can be mathematically categorized as the first central pattern generator in the spinal cord apart from gait¹⁷¹ and that coherence at a distance develops at the ends of the spine.¹⁷⁵ Different experiments conducted 10 years apart demonstrated similar mathematical signals, thus this mathematical approach to studying coherence in the spine may lead to a new measure for evaluating the CNS.¹⁷⁵

Boone's Journal of Vertebral Subluxation Research (1996-1997)

In 1996, Ralph Boone started the *JVSR* and continued as the editor until 2000.^{24,177,178} He completed a PhD in biology from the University of Richmond in 1974. From 1980 to 1990, he was the director of research and computers

at Sherman College of Chiropractic. He earned his chiropractic degree from Sherman College of Chiropractic in 1990. Boone was president of Southern California College of Chiropractic from 1990 to 1994, president of the Straight Chiropractic Accrediting Agency in the 1990s, acting head of the New Zealand School of Chiropractic from 1998 to 2000, director of research for the Association for Network Care from 2002 to 2004, and director of research at Sherman from 2004 to 2009. Boone died on November 21, 2010 (Fig 9).¹⁷⁹

There is some confusion in the literature about JVSR being a journal and that articles are refereed. For example, McGregor-Triano writes, “the JVSR is not classified as a ‘journal’ (Ulrich’s Periodicals Directory),” and “is considered by Ulrich’s Periodical Directory (2006) to be ‘academic’ and ‘scholarly.’”¹⁸⁰ In contrast to McGregor-Triano’s claims, Ulrichsweb’s Global Serials Directory in 2015 lists JVSR serial type as a refereed and peer-reviewed “journal.”²⁵ Only the content type is described as “Academic/Scholarly.”²⁵ Furthermore, queries to several of the early authors and reviewers from the first issues suggest that Boone was heavy-handed as an editor and perhaps even unusual in his approach to peer review but that he certainly sent papers out for review and requested revisions and resubmissions.^{160,169,179,181} According to Graham Dobson (personal correspondence, September 13, 2016), it was not Boone’s intention to develop a top-tiered journal like *Spine*. Boone relied on his 2 decades as an academic and a scientist to shape his editorial style.¹⁸²⁻¹⁸⁷

In the first issue of *JVSR*, Boone summed up the mission of the journal and his hopes for CVS research.²⁴ He acknowledged there was plenty of research to do. He proposed that the etiology, biomechanics, physiology, and consequences of CVS justified the journal’s narrow focus. Boone believed that without a journal dedicated to publishing peer-reviewed literature on all aspects of the CVS, studies on spinal manipulative therapy for low back pain and musculoskeletal conditions may dominate the

literature. He acknowledged that those research foci may be interesting, but if they were to dominate the literature we would not “expand our evidence base of vertebral subluxation further than it being a spinal lesion associated with various pathologies.”²⁴ He recommended a comprehensive research strategy including multiple theoretical and clinical perspectives.

Boone focused the journal on publishing articles describing investigative methodologies and appropriate paradigms through which to test various hypotheses. The first issue included 2 papers on CVS models with the hopes of expanding perspectives and reassessing CVS.^{5,9,24}

The objective of the first volume was to include a wide range of methods to clarify and describe models of CVS and increasing public awareness of the benefits of CVS correction and to publish innovative research. Besides the papers on models,^{5-7,9} the first volume included technique papers,^{3,188} research on surface electromyography paraspinal normative data,^{189,190} case reports,¹⁹¹⁻¹⁹³ small research designs,¹⁹⁴⁻¹⁹⁸ a survey report on guidelines,¹¹ and retrospective studies including the Blanks study, which was the largest chiropractic study on quality of life to date.¹⁶²

In the second volume published in 1998, Boone reflected on the papers from 1996 and 1997.¹⁷⁸ He claimed that scientific evidence had accrued indicating positive health benefits after or concomitant with CVS correction. The 3 areas he noted were that health benefits accumulated, improved function was promoted, and physiological and neurological changes occurred.^{11,161,169,189-208} Boone acknowledged that some areas of CVS research were more difficult to study and concluded that the neurological components would take the most effort to elucidate.¹⁷⁷ He established relationships with social scientists, biological scientists, and engineers at the University of California, enlisting several PhDs to explore some of the more elusive phenomena. In 2000, Matthew McCoy, a Life Chiropractic College and Emory graduate, became editor, and in 2011 the journal changed its name to *Annals of Vertebral Subluxation Research*.²⁰⁹⁻²¹¹



Fig 9. Ralph Boone.

Kent’s Models (1996). Christopher Kent graduated from PCC in 1973. He joined the faculty upon graduation, worked in the research department, and was elected president of the faculty senate. He was invited as one of 11 chiropractic researchers to participate in the National Institutes of Health workshop on The Research Status of Spinal Manipulative Therapy in 1975.⁴² After entering private practice in the 1980s, he focused on developing objective measures to monitor nerve interference related to CVS. In 2001, he was elected chair of the United Nations Non-Governmental Organization Health Committee. In 2010, he founded the Foundation for Vertebral Subluxation, of which he is president, with McCoy. In 2016, he was named director of evidence-informed curriculum and practice at Sherman College of Chiropractic (Fig 10).^{212,213}



Fig 10. Christopher Kent.

In 1996, Kent's article "Models of Vertebral Subluxation: A Review" was published in the first issue of the *JVSR*.⁹ The article referenced the histories of Haldeman,²¹⁴ R. J. Watkins,²¹⁵ Terrett,²¹⁶ and Rome and concluded that such an entity must exist.² He defined Stephenson's 4-component model based on B. J. Palmer's work, otherwise known as MOPI or malposition, occlusion of an opening, pressure or impingement, and interference to the transmission of mental impulses.²¹⁷ Kent then described the models of Faye, Dishman, and Lantz.^{34,35,218,219}

Kent explored the major components of CVS by reviewing the basic science and clinical literature on the topic. He started with the joint degeneration model and the neurological consequences. These included cord compression, nerve root compression, local irritation, vertebral artery compromise, and autonomic dysfunction. The other models he reviewed included the nerve root compression model, the dysafferentation model, and the neurodystrophic model. After describing 15 references on the compression model, Kent concluded, "While some may criticize the 'garden hose' model as being overly simplistic, the nerve root compression hypothesis is far from obsolete."⁹ The dysafferentation model proposed by Kent involved the nociceptive and mechanoreceptive structures. The neurodystrophic model, according to Kent, relates directly to tone. It links neural dysfunction to pathogenesis via the intertwined nature of the nervous system, endocrine system, and immune system.⁹

Kent called for an operationalized model that accounted for the many neurobiological models and was broad enough for the many clinical operational models.⁹ Outcomes assessments should be developed for conceptual models, analytic procedures, type of adjustment, and criteria for

success or failure. Based on previous classifications, Kent adopted Dan Murphy's 3 classes of CVS models: segmental models, postural models, and tonal models.⁹

Kent proposed that the methodologies for correcting CVS have a common neurological objective.⁹ Models to demonstrate objective clinical outcomes could be developed for any method as long as they measure evidence for improved "functional integrity of the nervous system, and improvement in general health and quality of life indicators."⁹ He suggested that researchers focus their efforts on practice procedures that are efficient and predictable.

Boone and Dobson's Vertebral Subluxation Model (1996-1997). Ralph Boone and Graham Dobson wrote a 3-part article in the first 3 issues of *JVSR*.⁵⁻⁷ They proposed the vertebral subluxation model (VSM) as a way to integrate all previous models and to research CVS on many levels of complexity. Dobson graduated from PCC in 1971. He was dean of clinical sciences at Sherman College from 1979 to 1982, vice president of the chiropractic program of Southern California College of Chiropractic from 1990 to 1994, and interim president of Southern California College of Chiropractic from 1994 to 1995, and has held various positions at the NZ New Zealand School of Chiropractic SC (now the New Zealand College of Chiropractic) since 1998 (Fig 11).²²⁰ In the late 1990s, Dobson developed his own CVS analysis by integrating methods from Goodheart and Blair, as well as White and Panjabi.²²¹

Boone and Dobson proposed the VSM to integrate the traditional concept of B. J. Palmer's early vertebral subluxation model (EVSM), Faye's VSC, Dishman's chiropractic subluxation complex (CSC), and Lantz's VSC model (VSCM).⁵ The VSM integrated the models from the 1980s with the early model from B. J. Palmer,



Fig 11. Graham Dobson.

along with the literature on outcomes, health-related quality of life, and proposed neurological models of mental impulse (Fig 12).⁵

The papers by Boone and Dobson included quality of life. The articles explored the VSM in 3 parts: physiological and biomechanical,⁵ health and etiology,⁶ and interdisciplinary research methodologies appropriate for testing the VSM.⁷ The articles were in part an answer to Keating's call to put politics and propaganda aside and conduct serious research on CVS.⁷⁰ In the first article, they quote from Keating's 1992 book:

What of subluxation? Will we ever set aside the political uses of these supposed spinal boo-boos long enough to operationally define and investigate their potential role in health and illness? If we were to cease propagandizing subluxation as "the silent killer" and study it as a serious scientific phenomenon, who knows what we might find? Yet, so long as we insist on emphasizing the chiropractic lesion as our political "raison d'être," the real "tragedy of the subluxation" will continue to be our ignorance of it.⁷⁰

Boone and Dobson partially agreed with Keating. An operational definition was essential. They suggested that consensus definitions should arise from specific operational definitions tailored to test each component of CVS, followed by progressive studies, which might then be developed into a functional definition. From there, further

operational definitions could emerge (Fig 13). In response to this quote, they wrote:

The present model is designed to accept this challenge. In doing so, it becomes necessary to develop a functional definition which also encompasses parameters dealing with etiology and health and to include, for scientific investigation, those aspects of the vertebral subluxation which are likely to impact on these phenomena.⁵

Boone and Dobson started by exploring aspects of the early CVS that had evidence and aspects of detection that were repeatable.⁵ They did not accept the early theory outright. Rather, they focused on evidence for the theories associated with the early model, namely B. J. Palmer's 4 components of CVS: misalignment of a vertebra, occlusion of a foramen, pressure on nerves, and interference with mental impulse flow. Included in their functional definition was the fourth component or the organizing information analogous to the mental impulse. Boone and Dobson pointed out that one of the failings of modern definitions is the exclusion of the mental impulse hypothesis.⁵

By expanding research questions, they suggested we might be able to test hypotheses that were previously thought untestable. They noted that it was a mistake to assume that mental impulse was adequately described as the action potential. For example, they suggested that the mental impulse theory, when viewed as a complex hypothesis, might be tested by examining factors that were involved with neurally mediated organizing coordination information.⁵ These might

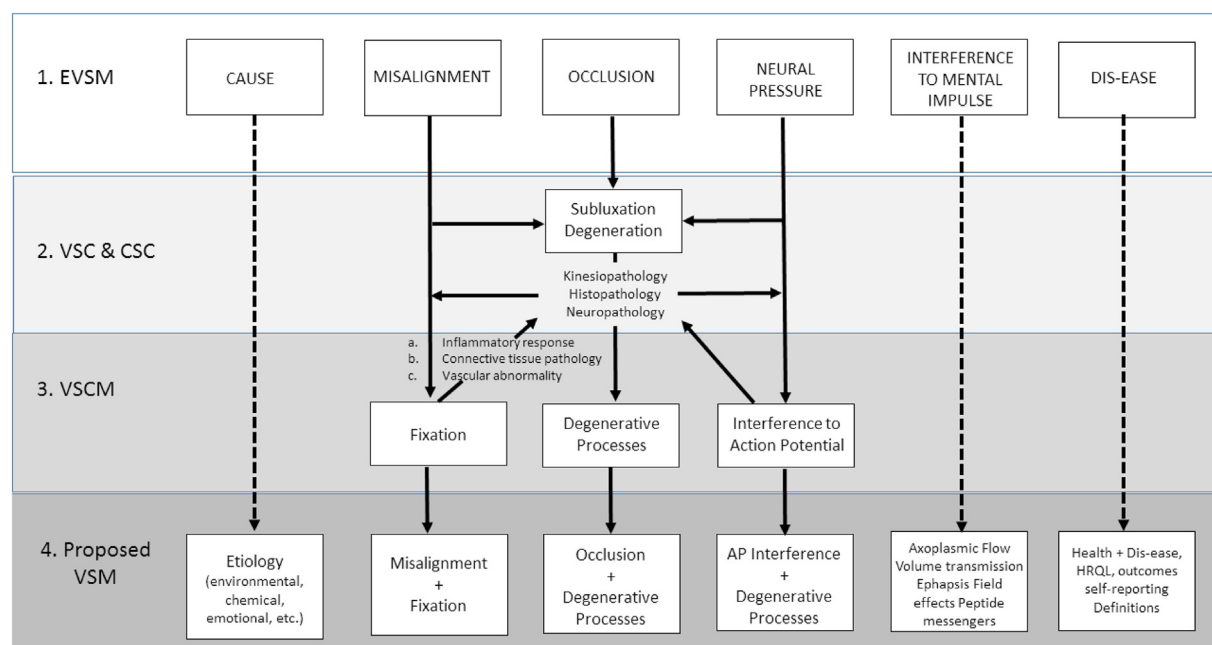


Fig 12. Redrawn from the original, this depicts the VSM as an integration of all of the recent models with the early models.

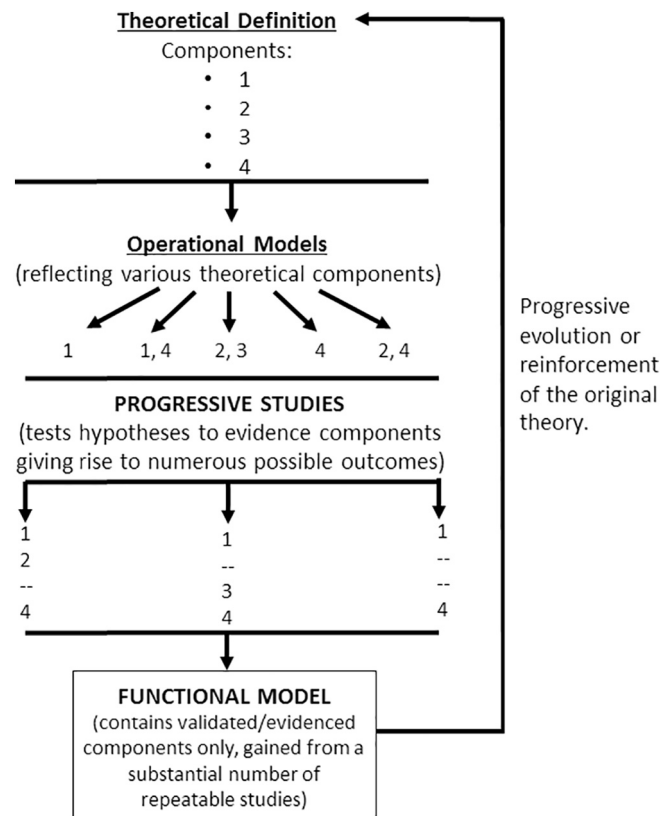


Fig 13. Redrawn from Boone and Dobson's functional model.

include neural transmission outside of the action potential, such as growth factors, ephaptic transmission, axoplasmic transport, the propulsion of energy and information from nerve to nerve such as neurotransmitters, and alternative export of molecules for sliding filaments, bidirectional movements, and antero-grad and retrograde flow.⁵

Boone and Dobson critiqued the recent trend in the profession of redefining the traditional theory without adequate testing and evidence to do so. For example, the mental impulse was equated to action potential by Haldeman and Drum in 1971.²²² Other theorists sought ways to integrate the mental impulse hypothesis. R. J. Watkins addressed this issue and emphasized the importance of the quality of the impulse in 1965; he related it to the neurology of the joint getting detuned, whereas the adjustment retunes the joint neurology.^{30,223} It was also proposed that research into subtle energy systems and energy medicine might be appropriate avenues to pursue research into the mental impulse concept.^{224,225}

Because of the variation in practice, philosophy, and definitions within the profession, Boone and Dobson suggested an encompassing functional definition of CVS, as follows:

A vertebral subluxation is a potentially reversible and/or preventable alteration of the intervertebral relationships

of one or more articulations of the spinal column or its immediate weight bearing components of the axial skeleton; accompanied by a change in the morphology of the tissue occupying the neural canal and/or intervertebral foramina; as well as an alteration of neural function sufficient to interfere with the transmission of organizing information, believed to be homologous to the mental impulse, thus contributing to negative health outcomes.⁵

This functional definition was designed to include many testable tenets and form a basis for several operational definitions.

Critical Analysis

Several important areas of discussion arise from an analysis of a sample of the literature from this period. The main areas to discuss include omissions of literature and lack of critical discourse, historical accuracy, questions about the reliance on reliability studies, and critiques of consensus.

Omissions of Literature and Lack of Critical Discourse From 1996 to 1997. Some papers during this time omitted literature that could have informed the authors and potentially led to different conclusions. Such oversights could have been due to limited distribution of literature, poor searching strategies, a lack of indexing of the source material, dismissivism,²²⁶

intraprofessional politics,²⁷ gatekeeping,²²⁷ or scholastic error. Any of these issues may have occurred in a single paper. Sometimes references may have been omitted for the authors to support perspectives that were personally or politically motivated. McAulay pointed out problems in the chiropractic literature that stem from this dismissivist approach.²²⁶ Villanueva-Russell claimed that some academics were staging a coup by using journals, lexicon cleansing, and evidence-based standards to control the profession's identity.²²⁷ This is related to the medicalization of "regular" chiropractic, mentioned by McAulay in 1995.²²⁸ Dismissivism may include a lack of historical references to support positions.

A few articles important to the dialogue on CVS have not been well cited. It is not clear if this is because the sources were difficult to find, locate, or obtain in search engines. PubMed did not include many chiropractic publications until after 2002. Until that time, the *Journal of Manipulative and Physiological Therapeutics* was the only chiropractic journal included in MEDLINE starting from 1982. Few other indexing systems of the period indexed chiropractic periodicals or else they charged for the use of the service, placing barriers to access the information. Most of these search engines, other than PubMed, required a fee for use. The only search engine that focuses on chiropractic literature, the Index to Chiropractic Literature, was only in print format until 2001, and each issue was released for reference the year after research papers were published. This made it difficult to obtain papers for citation. The Index to Chiropractic Literature was not released in a web-based and open-access format until 2001. For example, Ruch's *Atlas*¹⁵ was cited in only 4 chiropractic journals and 4 nonchiropractic journals, according to Google Scholar.²²⁹⁻²³⁵ Epstein's works are rarely cited in the literature.^{3,168} Kent's 1996 review,⁹ which proposed the dysafferentation approach to CVS, was followed by a paper by Seaman and Winterstein, titled "Dysafferentation: A Novel Term to Describe the Neuropathophysiological Effects of Joint Complex Dysfunction."²³⁶ The article references many of the same sources, such as Bogduk and Korr; however, the 1998 article did not cite Kent's 1996 article.^{9,236}

Keating's and Nelson's articles from this time are well-cited in the literature, but the critiques of their articles are few.^{1,10,114} This paucity could have many reasons, such as apathy, journal bias, gatekeeping, and possibly that the articles are considered well written and well referenced without the need for further critique. However, if 88 percent of the profession seemed happy to keep the term *subluxation*,²³⁷ our profession might have lacked rigorous professional discourse. This was proved further when an article that was dismissive of the historical constructs of CVS⁴⁷ went without critical response publications or letters to the editor.

Not citing existing sources about CVS could weaken arguments for or against it. This is evident in Nelson's

article where he stated his opposition to the profession-wide, 3-year-long, consensus process. He wrote:

The authors have begun the consensus process apparently assuming that agreement exists that there is a particular type of lesion that is the focus of the chiropractic profession. Obviously, some chiropractors believe in the existence of subluxations, but it is equally obvious that many do not.

Nelson provided no references for this contention, including the references about the widespread consensus across 30 years in the profession (through 1997) about subluxation.^{12,92,98-100,215,238-240} His critique was written 5 years after the consensus process was complete, suggesting that this information was available. The consensus included dozens of stakeholders from most schools and organizations.¹²

Missing the Neuropathic Perspective. Speransky's neuropathic theories were integrated into CVS models starting in the 1930s.²⁴¹⁻²⁴⁴ This integration continued into the 1990s by chiropractors who found that the empirical evidence in Speransky's research and theory was congruent with chiropractic's central paradigm.^{142,241,245} Theorists such as B. J. Palmer,¹⁴¹ Watkins,³⁰ Janse,²⁴⁰ Weiant,^{246,247} Verner,¹¹¹ Homewood,⁴⁴ and Harper included Speransky and other Russian neurophysiology in their models.²⁴⁸ By the 1960s, the neuropathic perspective dominated the profession. This approach was explained by R. J. Watkins:

Hence the classic chiropractic definition of a subluxation can be better stated as an "intervertebral subluxation with consequent neuropathy." Since this is definitely not always the case there are the following combinations seen and described:

1. Subluxation—minor muscle imbalance with no consequent neuropathy, (These usually clear quickly and easily—no vasodilation failure.)
2. Subluxation with consequent neuropathy. (Classic chiropractic specialty.)
3. Subluxation as a symptom of a neuropathy. (Local or remote) This type of subluxation as a symptom can initiate further neuropathies to become a complex chain.

Any neuropathy can also exist as a self-perpetuating vicious circle, after the original subluxation has physically disappeared. This emphatically illustrates the critical importance of the time factor. Each patient is the sum total of all prior neurological experience.³⁰

Some of the literature of the late 1990s included a neuropathic approach. Epstein incorporated it into his models and also integrated several other Russian neuropathic perspectives from Kositsky, Ukhtomsky, Luria, and Bernstein.^{134-136,155,249} This neuropathic perspective on the CVS is lacking in much of the recent critical literature.^{47,250-253} This may be in part due to the 1970s

research emphasizing pain disorders related to CVS rather than the pathophysiology associated with neurodystrophic and neuropathic processes.^{42,254-255} Nevertheless, this element of theory should not be ignored and should be included in critical appraisals.

Keating's body of work used little neuropathic literature. Based on his use of references, Keating's descriptions of CVS in his early writings did not include a comprehensive review of chiropractic research literature that was published between 1928 and 1980,^{59,61,256} such as theories about vertebrogenic reflexive pathophysiological processes of CVS theory; Speransky's theory; or works of R. J. Watkins, B. J. Palmer, Verner, Harper, and Weiant. As Keating's publications evolved and he eventually mastered some of the historical literature of chiropractic, he did not alter his initial assumptions.^{47,52,54,257,258} His basic arguments remained the same over the course of 30 years of publishing even though he developed those arguments before having referenced a large portion of CVS theories.^{59,60} Keating stated that he did not know how CVS could be studied non-symptomatically or as an overall neural dysfunction.⁷²

Keating et al critiqued the use of the term *subluxation* in the ACC consensus statement as "dogmatic."⁴⁷ In the paper, the authors mentioned parallels to the Russian school of "nervism" in relation to the altered function attributed to CVS; however, they make this connection to dismiss models from "nineteenth century neurology and physiology."⁴⁷ They do not link that line of thought to chiropractic literature classified as Speranskian subluxation theory, which made reference to 20th century neurophysiology research conducted in Russia.²⁴⁵ Sechenov's school of nervism was carried forward through research by his students Pavlov and Ukhtomsky, and also by other Russian neurophysiologists, most notably Speransky.²⁵⁹

The paper critiqued the ACC paradigm as embracing "subluxation dogma," not delineating a more precise definition of how "neural integrity" is compromised, and not demonstrating the empirical evidence about the clinical meaningfulness of CVS.⁴⁷ Beyond the lack of reference to the neuropathic perspective, the authors offered a limited viewpoint about what validity claims should be considered as adequate for testing hypotheses and lacked references to historical and recent literature. Including a full spectrum of historical references in modern discussions about CVS is important to ensure arguments are balanced and well cited. This could lead to more complete viewpoints and ideally to testable hypotheses that could be further studied.

Historical Inaccuracies in the Literature. Several of the articles in the literature cited during this time period contain historical inaccuracies. Some historical errors may have been due to barriers to accessing information, which left authors to make conclusions with missing information. Modern technology, such as powerful computer search engines, has allowed for historical facts to emerge from newspaper and archived databases. It is not too late to add

updates to the literature by filling in gaps with historical facts.

Keating and Mootz proposed that chiropractors in the 1930s and 1940s were afraid to publicly criticize their own cherished ideas, which they argued led to a lack of reputable research on CVS.⁶⁶ The examples given were that chiropractors used the statement "chiropractic works" to prove efficacy and that chiropractors only researched the "how and why" but not effectiveness.⁶⁶ They referred to this as part of the insidious dogma. They proposed that chiropractors felt "That chiropractic is a science *because* it is rational (ie, consistent with basic science), that the validity of chiropractic theory is determined by its plausibility, and that the clinical value of the chiropractic healing art can be judged on the basis of private (unpublished) uncontrolled observations."⁶⁶ The same argument was used by Keating in other articles but these have yet to be critiqued in the literature.^{59,61,65,67,70,260-262}

Although it may be true that D. D. Palmer wrote that chiropractic "makes a rational claim upon the afflicted,"²⁶³ chiropractors did not only develop unpublished private models nor did they all suggest that chiropractic was valid only because it was congruent with science and rationale. Verner said it was both; he writes, "Chiropractic is truly scientific and truly rational."¹¹¹ Chiropractors held conferences from the 1920s to the 1960s; tested hypotheses; established labs; published their thoughts on every element of chiropractic in both self-published texts and professional journals and magazines; and developed dozens of theoretical, analytic, diagnostic, and corrective methodologies. Keating and Mootz's statement has some merit, but perhaps it should not be used to characterize all of the history of CVS research in chiropractic.

In a similar critique, Nelson attributed CVS theory from the early years of the profession, especially the bone-out-of-place model, to D. D. Palmer.¹ As Keating noted, this was not D. D. Palmer's definition; rather, Palmer emphasized the subluxated joint impinging on a nerve.⁷¹ Thus, Nelson's conclusion that modern CVS theory should be abandoned if it does not link to D. D. Palmer's theory may be based on a mistaken interpretation of Palmer's original theory.

How historical facts are interpreted or presented may influence later publications. An example from the 1996-1997 literature is Keating's quote of D. D. Palmer about relieving human suffering and how, according to Keating's interpretation, this could imply that D. D. Palmer included other methods within chiropractic.⁷² In writing about this topic in his 1992 paper,⁷² Keating quoted and cited from a secondary source, which was page 272 of Rehm's *Necrology*.²⁶⁴ As did Rehm, Keating used the first part of the passage written by D. D. Palmer. Keating wrote about D. D.:

His Port Perry, Ontario monument quotes him as saying: 'I never considered it beneath my dignity to

do anything to relieve human suffering' (16, p. 272). Additionally, the founder of chiropractic probably continued in some of the clinical procedures involved in his magnetic healing days (ie, pre-1895)...⁷²

The original writing by Palmer was on page 322 of his tome in a chapter about adjusting for corns and bunions. D. D. Palmer wrote, "I never felt it beneath my dignity to do anything to relieve human suffering. The relief given bunions and corns by adjusting is proof positive that subluxated joints do cause disease."¹¹³

When Keating first used the quote in 1992,⁷² perhaps he was unaware of the full statement by D. D. Palmer. Rehm was referring to what was etched into a monument in Ontario, Canada that was dedicated to D. D. Palmer in Ontario.²⁶⁴ Use of a partial quote placed it out of context.

Misuse of this quote had apparently been a contentious issue for decades. Even as far back as 1957, B. J. Palmer pointed out this matter. He wrote:

Frequently, we find FIRST sentence ONLY, quoted, which, by itself, makes it appear that D.D. Palmer believed in and practiced "Anything to relieve human suffering," such as air, light, heat, water, diet, exercise, vitamins, food supplements, physiotherapy, naturopathy, colonic irrigations, massage, ad infinitum, ad nauseum. The motive of quoting ONE sentence, **apart from** its text, pretext and context, it to think others justify things THEY do by what D.D. Palmer did NOT believe in and DID NOT do.²⁶⁵

Keating quoted from page 322 of Palmer's original text the entire paragraph in a later publication.²⁶⁶ However, to the best of this author's knowledge, Keating never wrote about Palmer's "felt it below my dignity" comment in its full context.⁷² Even though Keating used the full quote in a later paper, he never corrected the literature or pointed out how the partial use of the quote led to inaccuracies in the literature.

In some literature, D. D. Palmer stated that he did not include other methods with chiropractic. For example, in a letter to B. J. in 1902, D. D. Palmer explained how his older methods actually would "undo" his chiropractic adjustment. He wrote:

I have no use for those books on "Nature Cure," as I have been over the whole field and have outgrown them. It is a positive fact that after we Chiropractics have done the right thing, that we should not undo what we have done. I.e. for e.g. Mama has me to treat her Chiro. Then I must treat her Magnetic and undo what I have done. By Chiro. I free the nerves

and set them in action, by magnetic I soothe them and quiet them, give them ease.²⁶⁷

Documents from D. D. Palmer's earliest days as a magnetic healer from 1886 until his death in 1913 are available.^{148,268-274} In the documents cited, Palmer did not indicate that chiropractic was anything more than adjusting the articulations to relieve nerve impingement to aid human suffering. Palmer stated that chiropractic was distinct from all methods he had previously studied.^{113,267}

Interpretations such as Keating's may have led to a misunderstanding of D. D. Palmer's paradigm, especially when Keating helped to shape historical interpretations of D. D. Palmer.⁷¹ This has the potential to fuel the intraprofessional debates with information that may not be accurate.

In any literature there will be myriad interpretations of material and a continued need to update historical research. Some final points to consider are presented here. Papers by Kent, Boone, and Dobson lack reference to Faye's earliest edition of his manual from 1980.^{5,9,275} Faye originated the VSC.¹¹⁴ Kent referred to Faye's 1983 edition and assumed that Flesia's 1982 description of the model predated Faye.⁹ Also, Boone and Dobson acknowledged that they were not able to trace the origins of VSC and thus relied on Flesia.⁵

Relying on Reliability Studies. Keating advocated for validity studies as a standard that the profession should focus on regarding examination procedures, particularly those for CVS.¹⁰ In his earlier writings, Keating emphasized the value of other types of research, from case studies to other designs.^{59,70,276} His call for validity studies seemed to resonate with the profession. However, his references from these early years point to interexaminer reliability studies about low back pain, not to CVS correction.

In at least 3 of his writings, Keating referenced some reliability studies and time series studies from the 1980s to support his argument that CVS detection was not well researched.^{56,58,103} He shared this perspective with the profession through the literature. For example, in 1988, Keating referred to 3 interexaminer reliability studies from the 1980s when he wrote, "We are not yet able to relate the palpable and manipulable lesion to subluxation theory, in part because we do not yet agree on how to find these spinal boo-boos. The black box of the clinical subluxation has yet to be located, let alone pried open."²⁵⁶ This conclusion was based on reliability studies that showed researchers could reproduce their own findings but not one another's findings. This shaped Keating's perspective on CVS research. He continued:

It may be that we find so little agreement among examiners in many reliability studies of subluxation-detection because subluxation is not a meaningful clinical entity. Perhaps the greatest value of subluxation theory may be to have encouraged chiropractors to probe for them, and therefore to adjust/manipulate. In this context the success of chiroprac-

tic palpators in reproducing their own examination findings and occasional agreement among doctors might be seen as sources of superstitious reinforcement for an erroneous theory of adjustment.²⁵⁶

Keating acknowledged in his 1992 book⁷⁰ that inter-examiner studies were an important place to start even though validity studies are more important. He repeated much of the arguments from that book in his 1996 paper.¹⁰ The limited references do not fully support the assertions Keating made in his paper.¹⁰ There were not enough historical references on chiropractic's history of CVS research and theory to support such broad assertions.

For example, the references in the introduction to Keating's article related to low back pain research.¹⁰ Most references in the body of the paper pointed to reliability studies.¹⁰³⁻¹⁰⁸ Based on these references, Keating claimed there was no hard evidence for the validity of an operational definition for CVS.¹⁰ He claimed that chiropractic researchers had not established a relationship between CVS and health problems and that "the validity of the chiropractor's 'subluxation complex' has not been studied by chiropractors or anyone else."¹⁰ Keating stated that there was no standard to compare detection methodologies. In 2001, he continued this perspective when he stated that CVS as a reliably detectable and clinically meaningful phenomenon was untested.²⁶¹

Reliability studies of the future might model the recent studies that emphasize the training and self-review of the examiners.^{65,260} Such studies may point the way to a new era in reliability research and raise the standard through which to assess the adequacy of previous studies.^{277,278}

These new studies may offer an opportunity to redo the research upon which Keating based his original claims. Such studies could be undertaken with new methodology, which was developed by Holt et al²⁷⁷⁻²⁷⁹ and Cooperstein, et al.^{280,281} Cooperstein et al wrote:

It may be possible to repeat many other inter-examiner reliability studies, including studies of examination procedures other than motion palpation (thermography, x-ray line marking, etc.) with similar design modifications that may more meaningfully assess examiner agreement than the mostly discrete analysis that has been used up until now.²⁸⁰

Research and Critiques of Consensus Definitions. Calls during this period for more adequate and comprehensive operational definitions started with Keating and continued through Nelson, Kent, Boone, and Dobson.^{1,5-7,9,70} Various types of studies were proposed, including well-organized case reports, reliability studies, and other research designs. One common theme from this period was that consensus definitions were not valuable for research purposes and that operational and functional definitions were needed.^{1,5,10} Perspectives on this vary. Boone and Dobson agreed with

Keating that operational definitions should replace consensus definitions.^{5,10} However, they felt investigations should start with functional definitions and then lead to more specific operational definitions to be tested. Consensus definitions should then arise from the research.⁵ Kent suggested different operational definitions based on different models and methodologies.⁹ Nelson critiqued the process of consensus in general, especially the process that led to Gatterman's text and the ACC paradigm, while also calling for proposing and testing various hypotheses.^{1,4,36}

Many types of perspectives could be used to study the myriad ways CVS may influence individuals. Boone and Dobson's expanded VSM included research proposals that encompass many avenues of health-related quality of life in relation to CVS.⁵⁻⁷ In 1999, I proposed integration of the VSM and systems science with a somatobiological and psychospiritual view of health.¹⁶⁰ The intent was to capture the emergent psychospiritual aspects of health-related quality of life expression traditionally associated with chiropractic and the adjustment of CVS.¹⁶⁰

Limitations

This article reflects one person's interpretation of historical writings and theories. This paper covers concepts and events that are modern enough that they can be reviewed from the perspective of current events, which leaves the historical interpretation open to bias by current perspective. A lack of clear inclusion and exclusion criteria for the material covered in this paper is a limitation that must be noted, as it influences the content, interpretations, and conclusions of the paper. Others may include additional literature or have other opinions that may potentially lead to different conclusions.

CONCLUSION

This brief period demonstrated that there were perspectives on CVS from streams of discourse in chiropractic's history of ideas. Rather than focus on limited sets of ideas organized around a handful of practitioners, researchers, or scholars, future developers of the profession could draw upon the spectrum of chiropractic's complex history. The challenge is to integrate the best from all historical and modern ideas with the rigors of science and the tools of philosophy.

The peak of chiropractic scholarship during this era rested upon prior research and theory. An accurate history of ideas could be used as a critical tool to evaluate the veracity of arguments set in their historical context. No models or theories appeared in a vacuum. Being informed by the history of ideas is a powerful method that we can use to evolve as a profession. In researching the CVS, we should consider exploring plausible hypotheses put forward from chiropractic history.

ACKNOWLEDGMENTS

The author acknowledges Brian McAulay, DC, PhD, David Russell, DC, Donald Epstein, DC, Stevan Walton, DC, and the Tom and Mae Bahan Library at Sherman College of Chiropractic for their assistance.

FUNDING SOURCES AND CONFLICTS OF INTEREST

The author received funding from the Association for Reorganizational Healing Practice and the International Chiropractic Pediatric Association for writing this series of papers. No conflicts of interest were reported for this study.

CONTRIBUTORSHIP INFORMATION

Concept development (provided idea for the research): S.A.S.

Design (planned the methods to generate the results): S.A.S.

Supervision (provided oversight, responsible for organization and implementation, writing of the manuscript): S.A.S.

Data collection/processing (responsible for experiments, patient management, organization, or reporting data): S.A.S.

Analysis/interpretation (responsible for statistical analysis, evaluation, and presentation of the results): S.A.S.

Literature search (performed the literature search): S.A.S.

Writing (responsible for writing a substantive part of the manuscript): S.A.S.

Critical review (revised manuscript for intellectual content, this does not relate to spelling and grammar checking): S.A.S.

Practical Applications

- This series of articles provides an interpretation of the history and development of chiropractic vertebral subluxation theories.
- This series aims to assist modern chiropractors in interpreting the literature and developing new research plans.

REFERENCES

1. Nelson C. The subluxation question. *J Chiropr Humanit.* 1997;7:46-55.
2. Rome P. Usage of chiropractic terminology in the literature: 296 ways to say "subluxation": complex issues of the vertebral subluxation. *Chiropr Tech.* 1996;8(2):49-80.
3. Epstein D. Network spinal analysis: a system of health care delivery within the subluxation-based chiropractic model. *J Vert Sublux Res.* 1996;1(1):51-59.
4. The ACC chiropractic paradigm. 1996. Available at: <http://www.chirocolleges.org/resources/chiropractic-paradigm-scope-practice/>. Accessed December 5, 2018.
5. Boone W, Dobson G. A proposed vertebral subluxation model reflecting traditional concepts and recent advances in health and science. *J Vert Sublux Res.* 1996;1(1):19-36.
6. Boone W, Dobson G. A proposed vertebral subluxation model reflecting traditional concepts and recent advances in health and science: part II. *J Vert Sublux Res.* 1996;1(2):23-32.
7. Boone W, Dobson G. A proposed vertebral subluxation model reflecting traditional concepts and recent advances in health and science: part III. *J Vert Sublux Res.* 1997;1(3):25-34.
8. Bergmann T. Toward a reliable, valid method of manual diagnosis: more than the sum of its P.A.R.T.S. *ACA J Chiropr.* 1997;October:24-27.
9. Kent C. Models of vertebral subluxation: a review. *J Vert Sublux Res.* 1996;1(1):1-7.
10. Keating J. To hunt the subluxation: clinical research considerations. *J Manipulative Physiol Ther.* 1996;19(9):613-619.
11. Kent C, Rondberg T, Dobson M. A survey response regarding the appropriateness of professional practice guidelines to subluxation-based chiropractic. *J Vert Sublux Res.* 1996;1:13-22.
12. Gatterman M. Development of chiropractic nomenclature through consensus. *J Manipulative Physiol Ther.* 1994;17(5):302-309.
13. Bergmann T, ed. Proceedings of the first consensus conference on validation of chiropractic methods, No. 2. *J Chiropr Tech;* 1990.
14. Kent C. An analysis of the General Chiropractic Council's policy on claims made for the vertebral subluxation complex. *Philos Dialogues.* May 16, 2011:1-9.
15. Ruch W. *Atlas of Common Subluxations of the Human Spine and Pelvis.* Hayward, CA: Life West Press; 2014.
16. Cramer G, Scott C, Tuck N. The holey spine: a summary of the history of scientific investigation of the intervertebral foramina. *Chiropr Hist.* 1998;18(2):13-24.
17. Swanberg H. *The Intervertebral Foramina in Man; The Morphology of the Intervertebral Foramina in Man, Including a Description of Their Contents and Adjacent Parts, With Special Reference to the Nervous Structures.* Chicago, IL: Chicago Scientific Publishing Co.; 1915.
18. Forster A. *The White Mark: An Editorial History of Chiropractic.* Chicago, IL: National Publishing Association; 1921.
19. Janse J. In memoriam: Fred W. Illi passes away. *ACA J Chiropr.* January 1984:94-95.
20. Winterstein J, Bachop W. The corporotransverse ligament at the L5/S1 intervertebral foramen: a gross anatomical-radiographic comparison. *Anat Rec.* 1990;226(4):111a.
21. P.A.R.T. guidelines. *ACA J Chiropr.* December 1999:44-45.
22. Bergmann T, Finer B. Back to basics: joint assessment-PARTS. *Top Clin Chiropr.* 2000;7(3):1-10.
23. Owens E. Chiropractic subluxation assessment: what the research tells us. *J Am Chiropr Assoc.* 2002;September:20-24.
24. Boone WR. Editor's perspective. *J Vert Sublux Res.* 1996;1(1):1.
25. Ulrichweb. Ulrichweb's global series directory. Accessed September 24, 2016.
26. Villanueva-Russell Y. Evidence-based medicine and its implications for the profession of chiropractic. *Soc Sci Med.* 2005;60:545-561.

27. Senzon S. Chiropractic professionalism and accreditation: an exploration of conflicting worldviews through the lens of developmental structuralism. *J Chiropr Humanit.* 2014;21(1):25-48.
28. Senzon S, Epstein D, Lemberger D. A historical perspective on network spinal analysis care: A unique insight into the spine's role in healing and wellbeing. *Chiropr J Aust.* 2017;45(4):305-323.
29. WFC policy statement adoption of the ACC paradigm: Approved by the Assembly of the World Federation of Chiropractic; Paris, May 23, 2001. *World Federation of Chiropractic*; 2001.
30. Walton S. *The Complete Chiropractor: RJ Watkins, DC, PhC, FICC, DACBR.* Asheville, NC: The Institute Chiropractic; 2017.
31. Drain J. *Chiropractic Thoughts.* 3rd ed. Asheville, NC: Integral Altitude Inc; 2013.
32. Rome PL. Terminology relating to the vertebral subluxation complex and the manipulative sciences. Part 1. *Chiropr J Aust.* 2017;45(2):73-89.
33. Rome PL. Terminology relating to the vertebral subluxation complex and the manipulative sciences. Part 2. *Chiropr J Aust.* 2017;45(2):90-130.
34. Faye LJ. *Motion Palpation of the Spine.* Huntington Beach, CA: Motion Palpation Institute; 1983.
35. Dishman R. Review of the literature supporting a scientific basis for the chiropractic subluxation complex. *J Manipulative Physiol Ther.* 1985;8(3):163-174.
36. Gatterman M. *Foundations of Chiropractic Subluxation.* St. Louis, MO: Mosby; 1995.
37. Brantingham J. A critical look at the subluxation hypothesis. *J Manipulative Physiol Ther.* 1988;11(2):130-132.
38. Leach R. *The Chiropractic Theories: A Textbook of Scientific Research.* 3rd ed. Baltimore, MA: Williams and Wilkins; 1994.
39. Panel of Advisors ACA Council on Technic. Chiropractic terminology: a report. *J Am Chiropr Assoc.* 1988;25(9):68.
40. Peterson D. Chiropractic glossary of commonly used terms. *J Am Chiropr Assoc.* 1988;25(10):46.
41. Green B, Johnson C, Keating J, Ted L, Shrader DC. FICC: a gentle force for improvement in chiropractic. 1998 Lee-Homewood Chiropractic Heritage Award recipient. *Chiropr Hist.* 1998;18(1):59-66.
42. Goldstein M. *The Research Status of Spinal Manipulative Therapy: A Workshop Held at the National Institutes of Health, February 2-4, 1975.* Vol. 15. Bethesda, MD: U.S. Department of Health, Education, and Welfare; 1975.
43. Korr I. *The Neurobiologic Mechanisms in Manipulative Therapy.* Berlin, Germany: Springer Science & Business Media; 1978.
44. Homewood AE. *The neurodynamics of the vertebral subluxation.* 3rd ed. Wildwood, Canada: Homewood; 1981.
45. Kimmel E. Electro analytical instrumentation: part 2. *ACA J Chiropr.* 1972;VI(S-42).
46. Leach R. *The Chiropractic Theories: A Textbook of Scientific Research.* 4th ed. Lippincott Williams & Wilkins; 2004.
47. Keating J, Charton K, Grod J, Perle S, Sikorski D, Winterstein J. Subluxation: dogma or science. *Chiropr Osteopat.* 2005;13(17).
48. Grod J, Sikorski D, Keating J. Unsubstantiated claims in patient brochures from the largest state, provincial, and national chiropractic associations and research agencies. *J Manipulative Physiol Ther.* 2001;24(8):514-519.
49. Fuhr A, Menke J. Status of activator methods chiropractic technique, theory, and practice. *J Manipulative Physiol Ther.* 2005;28(2):e1-e20.
50. Good C. The subluxation syndrome: a condition whose time has come? *J Chiropr Humanit.* 2004;11:38-43.
51. Huijbregts P. The chiropractic subluxation: implications for manual medicine. *J Manipulative Physiol Ther.* 2005;13(3):139-141.
52. Keating J. *B.J. of Davenport: The Early Years of Chiropractic.* Davenport, IA: Association for the History of Chiropractic; 1997.
53. Keating J. The specter of dogma. *J Can Chiropr Assoc.* 2001;45(2):76.
54. Keating J. Philosophy in chiropractic. In: Haldeman S, ed. *Principles and Practice of Chiropractic.* New York: McGraw Hill Companies, Inc.; 2005:77-97.
55. Keating J, Smallie D. The science of chiropractic: current status and future directions. *Calif Chiropr Assoc J.* 1984;28:20-21.
56. Keating J, Giljum K, Menke M, Lonczak R, Meeker W. Toward an experimental chiropractic: time-series designs. *J Manipulative Physiol Ther.* 1985;8(4):229-238.
57. Keating J, McCarron K, James J, Gruenberg J, Lonczak R. Urobehavioral intervention in the rehabilitation of lower urinary tract dysfunction: a case report. *J Manipulative Physiol Ther.* 1985;8(3):185-189.
58. Keating J, Seville J, Meeker W, et al. Intrasybect experimental designs in osteopathic medicine: applications in clinical practice. *J Am Osteopath Assoc.* 1985;85(3):192-203.
59. Keating J, Miller C. The science of chiropractic and the big idea. *Dyn Chiropr.* 1986.
60. Keating J, Nelson J, Mootz R. A model for clinical, scientific and educational development. *Res Forum.* 1986;2(4):103-104.
61. Keating J, Mootz R. Five contributions to a philosophy of the science of chiropractic. *J Manipulative Physiol Ther.* 1987;10(1):25-29.
62. Keating J. C.O. Watkins, D.C.: grandfather of the Council on Chiropractic Education. *J Chiropr Educ.* 1988;2(3):1-9.
63. Keating J. Beyond the theosophy of chiropractic. *J Manipulative Physiol Ther.* 1989;12:147-150.
64. Keating J. A survey of philosophical barriers to research in chiropractic. *J Can Chiropr Assoc.* 1989;33(4):184.
65. Keating J. Philosophical barriers to technique research in chiropractic. *Chiropr Tech.* 1989;1(1).
66. Keating J, Mootz R. The influence of political medicine on chiropractic dogma: implications for scientific development. *J Manipulative Physiol Ther.* 1989;12(5):393-397.
67. Keating J. Rationalism and empiricism vs. the philosophy of science in chiropractic. *Chiropr Hist.* 1990;10(2):23-27.
68. Keating J. Introducing the neurocalometer: a view from the Fountain Head. *J Can Chiropr Assoc.* 1991;35(3):165.
69. Keating J, Brown R, Smallie P. TF Ratledge, the missionary of straight chiropractic in California. *Chiropr Hist.* 1991;11(2):27-38.
70. Keating J. *Toward a Philosophy of the Science of Chiropractic: A Primer for Clinicians.* Stockton, CA: Stockton Foundation for Chiropractic Research; 1992.
71. Keating J. The evolution of Palmer's metaphors and hypotheses. *Philos Constructs Chiropr Prof.* 1992;2(1):9-19.
72. Keating J. Shades of straight: diversity among the purists. *J Manipulative Physiol Ther.* 1992;15(3):203-209.
73. Keating J, Brown R, Smallie P. One of the roots of straight chiropractic: Tullius de Florence Ratledge. In: Sweere J, ed. *Chiropractic Family Practice: A Clinical Manual.* Gaithersburg, MD: Aspen Publishers, Inc.; 1992.
74. Keating J, Rehm W. The origins and early history of the National Chiropractic Association. *J Can Chiropr Assoc.* 1993;37(1):27-51.

75. Keating J. Purpose-straight chiropractic: not science, not health care. *J Manipulative Physiol Ther.* 1995;18(6):416-418.
76. Keating J, Green B, Johnson C. "Research" and "Science" in the first half of the chiropractic century. *J Manipulative Physiol Ther.* 1995;18(6):357-378.
77. Keating J, Rehm W, William C, Schulze, MD, DC (1870-1936): From mail-order mechano-therapists to scholarship and professionalism among drugless physicians. *Chiropr J Aust.* 1995;25:122-128.
78. Keating J. The short life & enduring influence of the American Chiropractic Association, 1922-1930. *Chiropr Hist.* 1996;16(1):50-64.
79. Keating J. Letter to the editor. *Chiropr Hist.* 1996;16(1):13-14.
80. Keating J. A critical look at the subluxation hypothesis: to the editor. *J Manipulative Physiol Ther.* 1990;13(6):350-351.
81. Kaminski M, Boal R, Gillette R, Peterson D, Villnave T. A model for the evaluation of chiropractic methods. *J Manipulative Physiol Ther.* 1987;10(2):61.
82. *Chiropractic in New Zealand: Report of the Commission of Inquiry.* Wellington, N.Z.: Govt. Printer; 1979.
83. Roediger R. What happened to behaviorism. *APS Obs.* 2004;17(5):40-42.
84. Keating J. *The Effect of Setting and Therapist Contact With Child in Dry Bed Training for Childhood Nocturnal Enuresis* [dissertation]. Albany, NY: Psychology, State University of New York; 1981.
85. Huijbregts P. Dr. Joseph C. Keating, PhD, Litt. D (hon), FICC (hon). *J Manipulative Physiol Ther.* 2007;15(4):250-251.
86. Smallie D. Email correspondence with Simon Senzon on November 19, 2015.
87. Young KJ. Joseph C. Keating, Jr., Ph.D., Litt. D(hon), 1950-2007. *Clin Chiropr.* 2007;10(4):220-221.
88. Keating J, Callender A, Cleveland C. *A History of Chiropractic Education in North America.* Association for the History of Chiropractic; 1998.
89. Palmer.edu. Alumni: West campus graduates 30 doctors. Available at <https://www.palmer.edu/insights/issue.aspx?v=4&n=1&a=13>. September 23, 2015.
90. Barlow D, Hayes S, Gray-Nelson R. *The Scientist Practitioner: Research and Accountability in Clinical and Educational Settings.* New York: Pergamon Press; 1984.
91. BU.edu. BU: psychological and brain sciences: David H. Barlow, PhD; September 23, 2016.
92. Howe J. A contemporary perspective on chiropractic and the concept of subluxation. *ACA J Chiropr.* 1976;X(S-165).
93. Gregory AS. *Spinal Adjustment: An Auxillary Method of Treatment.* Oklahoma City, OK: Self-published; 1910.
94. Forster A. *Principles and Practice of Chiropractic.* 3rd ed. Chicago, IL: The National Publishing Association; 1923.
95. Howard J. *Encyclopedia of Chiropractic (The Howard System).* Chicago, IL: National School of Chiropractic; 1912.
96. Janse J, Houser RH, Wells BF. *Chiropractic Principles and Technic: For Use by Students and Practitioners.* 2nd ed. Chicago, IL: National College of Chiropractic; 1978.
97. Phillips R. *Joseph Janse: The Apostle of Chiropractic Education.* Los Angeles, CA: R. Phillips; 2006.
98. Phillips R. The irritable reflex mechanism. *ACA J Chiropr.* 1975;VIII(S-9).
99. Bittner H, Harper W, Homewood A, Janse J, Weiant C. Chiropractic of today. *ACA J Chiropr.* 1973;VII(S-82).
100. ACA. Chiropractic terminology: a report of the ACA Council on Technic. *ACA J Chiropr.* October 1988:46-75.
101. International Chiropractor's Association definition of subluxation. Washington, DC: ICA; 1987.
102. Internet Search of Google Scholar and CINAHL Database and Pubmed archives; October 5, 2015.
103. Boline P, Keating J, Brist J, Denver G. Interexaminer reliability of palpatory evaluations of the lumbar spine. *Am J Chiropr Med.* 1988;1(1):5-11.
104. Deboer K, Harmon Jr R, Tuttle C, Wallace H. Reliability study of detection of somatic dysfunctions in the cervical spine. *J Manipulative Physiol Ther.* 1985;8(1):9-16.
105. J K, Boline P. Inter- and intra-examiner reliability of motion palpation for the thoracolumbar spine. *J Manipulative Physiol Ther.* 1988;11(53-56).
106. Wiles MR. Reproducibility and interexaminer correlation of motion palpation findings of the sacroiliac joints. *J Can Chiropr Assoc.* 1980;24(2):59.
107. Zachman Z, Traina AD, Keating J, Bolles S, Braun-Porter L. Interexaminer reliability and concurrent validity of two instruments of the measurement of cervical ranges of motion. *J Manipulative Physiol Ther.* 1989;12(3):205-210.
108. Boline P, Keating J, Haas M, Anderson A. Interexaminer reliability and discriminant validity of inclinometric measurement of lumbar rotation in chronic low back pain patients and subjects without low back pain. *Spine.* 1992;17:335-338.
109. Faye LJ. *Spinal Motion Palpation and Clinical Considerations of the Lumbar Spine and Pelvis: Lecture Notes.* Huntington Beach, CA: Motion Palpation Institute; 1986.
110. Lantz C. Vertebral subluxation complex: basic model and clinical application. *Dyn Chiropr.* 1997;11.
111. Verner J. *The Science and Logic of Chiropractic.* 8th ed. Brooklyn, NY: Dr. P.J. Cerasoli; 1956.
112. Harper W. *Anything Can Cause Anything: A Correlation of Dr. Daniel David Palmer's Principles of Chiropractic.* 2nd ed. San Antonio, TX: WD Harper; 1974.
113. Palmer DD. *The Science, Art, and Philosophy of Chiropractic.* Portland, OR: Portland Printing House; 1910.
114. Faye LJ. The subluxation complex. *J Chiropr Humanit.* 1999;9.
115. About Dr. Ruch. Available at: <http://www.williamruchdc.com/index.php/about/>. Accessed September 28, 2016.
116. McCoy M. Book review: Atlas of common subluxation of the human spine and pelvis by William J Ruch, DC. *JVSR.* 2000;4(1):1.
117. Palmer DD, Palmer BJ. *The Science of Chiropractic.* Davenport, IA: The Palmer School of Chiropractic; 1906.
118. Gibbons R. Solon Massey Langworthy: keeper of the flame during the 'lost years' of chiropractic. *Chiropr Hist.* 1981;1(1):15-21.
119. Forster A. *Principles and Practice of Spinal Adjustment.* Chicago, IL: The National School of Chiropractic; 1915.
120. Illi F. *The Vertebral Column: Life-line of the Body.* Lombard, IL: National College of Chiropractic; 1951.
121. Breig A. *Biomechanics of the Central Nervous System: Some Basic Normal and Pathologic Phenomena.* Stockholm, Sweden: Almqvist & Wiksell; 1960.
122. Faye LJ. L. John Faye articles: 1996-1999. *Dyn Chiropr.* 1999.
123. Ward L. *The dynamics of spinal stress: spinal column stressology.* 3rd ed. Long Beach, CA: SSS Press; 1980.
124. Epstein D. Network chiropractic explores the meningeal critical. Part 2: "The disc syndrome" and the ultimate release. *Dig Chiropr Econ.* 1984;Mar/Apr;89:144-146.
125. Pert C, Ruff M, Weber R, Herkenham M. Neuropeptides and their receptors: a psychosomatic network. *J Immunol.* 1985;135:820s-826s.
126. Epstein D. Clinical origin of Network Chiropractic. Paper presented at: Network Chiropractic Modules A B C Intensive. July 19-21, 1991; Orlando, FL; 1991.

127. Epstein D. *Theoretical Basis and Clinical Application of Network Spinal Analysis (NSA) and Evidence Based Document*. Rev. XI. 8th ed. Longmont, CO: Innate Intelligence; 2005.
128. Senzon S, Epstein D, Lemberger D. The Network Spinal Wave as a Central Pattern Generator. Paper presented at: International Research and Philosophy Symposium. 2014; Spartanburg, SC; 2014.
129. Epstein D, Senzon S, Lemberger D. Reorganizational healing: a paradigm for the advancement of wellness, behavior change, holistic practice, and healing. *J Altern Complement Med*. 2009;15(5):475-487.
130. Epstein D. Network analysis part I: a unified application of chiropractic principles. *Dig Chiropr Econ*. 1983;March/April;57-58:138-139.
131. Epstein D. Network analysis part 2: general review of class B subluxations. *Dig Chiropr Econ*. 1983;July/Aug:18-23.
132. Epstein D. Network chiropractic explores the meningeal critical part I: anatomy and physiology of the meningeal functional unit. *Dig Chiropr Econ*. 1984;Jan/Feb;78-80:82.
133. Epstein D. *Network Notes: The Network Chiropractic Seminar Your Passport to Excellence*. Bellmore, NY: Network Lifeline, Inc.; 1986.
134. Epstein D. The spinal meningeal functional unit tension and stress adaptation. *Dig Chiropr Econ*. 1986;29(3):58-60.
135. Epstein D. Palpation as a critical tool to detect, classify, and understand central nervous system pathological dominance and the correlation of these findings to various models of vertebral subluxation. Paper presented at: Academy for Research in the Chiropractic Sciences. November 4-5, 1989; Philadelphia, PA; 1989.
136. Epstein D. *The chiropractic clear out: establishing the non-dominant dominant*. Wiseworld Seminars Archives (unpublished); 1990.
137. Epstein D. The human organism as a dissipating structure. Paper presented at: Network Chiropractic Seminar: Module F. April 1990; Monterey, CA; 1990.
138. Epstein D. Dynamic fluctuations between self and non-self as influenced by the Somatopsychic and Respiratory Waves, the Network Chiropractic Infinity Model. Paper presented at: Certification Level Intensive. October 1992; Longmont, CO; 1992.
139. Epstein D. Network Chiropractic Parameters. *Network Chiropractic Module B*. Innate Intelligence Inc; 1992.
140. Epstein D. Spinal system integrity. Paper presented at: Network Spinal Analysis: Basic Level Intensive. April 1996; San Francisco, CA; 1996.
141. Palmer BJ. *Clinical Controlled Chiropractic Research*. Vol. 25. Davenport, IA: Palmer School of Chiropractic; 1951.
142. Speransky A. *A Basis for the Theory of Medicine*. New York, NY: International Publishers; 1936.
143. Logan H. *Logan Basic Methods*. St. Louis, MO: Logan; 1950.
144. De Jarnette B. *Sacro Occipital Technic*. Nebraska City, NE: DeJarnette; 1933.
145. Cooperstein R, Gleberzon B. *Technique Systems in Chiropractic*. Philadelphia, PA: Churchill Livingstone; 2004.
146. Palmer BJ. *The Subluxation Specific the Adjustment Specific*. Vol. 18. Davenport, IA: Palmer School of Chiropractic; 1934.
147. Korr I. *The Collected Papers of Irvin M. Korr*. American Academy of Osteopathy; 1979.
148. Palmer DD. *The Chiropractor*. Los Angeles, CA: Press of Beacon Light Printing Company; 1914.
149. Toftness I. *Philosophy of Chiropractic Correction*. I.N. Toftness, DC, PhC; 1977.
150. Ward LE. *The Spinal Column Stressology Manual of Standard Practices*. 2nd ed. Long Beach, CA: SSS Press; 1980.
151. Faulkner T. *Letter to Donny Epstein*. Wise World Seminars Archives (unpublished); 1984.
152. Breig A. *Adverse Mechanical Tension in the Central Nervous System: An Analysis of Cause and Effect*. Stockholm, Sweden: Almqvist & Wiksell International; 1978.
153. Kositskiy G, Smirnov V. *The Nervous System and "Stress" (The Principle of Dominance in Pathology)*. Moscow/Washington, DC: Nauka Press/NASA; 1970/1972. NASA Technical Translation 653. Washington, DC: NASA; March 1972.
154. Korr IM. The spinal cord as organizer of disease processes: some preliminary perspectives. *J Am Osteopath Assoc*. 1976;76(1):35-45.
155. Epstein D. The stress connection: gauging the role of the nervous system. *Dig Chiropr Econ*. 1987;Dec/Jan:58-60.
156. Selye H. *Stress and Disease*. New York: McGraw-Hill; 1956.
157. Grof S. *Realms of the Human Unconscious*. New York: Viking Press; 1975.
158. Epstein D, Senzon S, Lemberger D. The seasons of wellbeing as an evolutionary map for transpersonal medicine. *Int J Transpers Psychol*. 2014;33(1):102-130.
159. Ingber D. Tensegrity and mechanotransduction. *J Bodyw Mov Ther*. 2008;12(3):198-200.
160. Senzon S. Causation related to self-organization and health related quality of life expression based on the vertebral subluxation model, the philosophy of chiropractic, and the new biology. *J Vert Sublux Res*. 1999;3(3):104-112.
161. Blanks R, Schuster T, Dobson M. A retrospective assessment of network care using a survey of self-rated health, wellness and quality of life. *J Vert Sublux Res*. 1997;1(4):11-27.
162. Boone W, Blanks R, Schuster T, Dobson B. *An evolving model reflecting Network Spinal Analysis (NSA) research*; 1999.
163. Blanks R, Schuster T, Dobson M, Jauregui M. Assessment of network spinal analysis in retrospective and prospective research design formats using a survey of self-reported health and wellness [abstr]. Paper presented at: Association for Network Care: Scientific Research Conference. November 17-18, 2001; Como, Italy; 2001.
164. Schuster T, Dobson M, Jauregui M, Blanks R. Wellness lifestyles II: modeling the dynamics of wellness, health lifestyle practices, and network spinal analysis. *J Altern Complement Med*. 2004;10:357-367.
165. Schuster T, Dobson M, Jauregui M, Blanks R. Wellness lifestyles I: a theoretical framework linking wellness, health lifestyles, and complementary and alternative medicine. *J Altern Complement Med*. 2004;10:349-356.
166. Blanks R. Reorganizational healing: a health change model whose time has come. *J Altern Complement Med*. 2009;5: 461-464.
167. Senzon S, Epstein D, Lemberger D. Reorganizational healing as an integrally informed framework for integral medicine. *J Integr Theory Pract*. 2011;6(4):113-130.
168. Senzon S, Epstein D, Lemberger D. The network spinal wave as a central pattern generator. *J Altern Complement Med*. 2016;22(7):544-556.
169. Bohacek S, Jonckheere E. Chaotic modeling in network spinal analysis: preliminary report. Nonlinear canonical correlation with alternating conditional expectation (ACE). *J Vert Sublux Res*. 1998;2(4):188-195.
170. Jonckheere E, Lohsoonthorn P, Mahajan V. Sensory motor instability and Central Pattern Generator in spinal oscillations. *Asian J Control (special issue)*. 2005.
171. Jonckheere E, Lohsoonthorn P, Musuvathy S, Mahajan V, Stefanovic M. On a standing wave Central Pattern Generator and the coherence problem. *Biomed Signal Process Control*. 2010;5(4):336-347.

172. Jonckheere E, Bohacek S, Lohsoonthorn P. Dynamic modeling of spinal EMG activity. Paper presented at: NSF Southwest Regional Workshop on New Directions in Dynamical Systems. Los Angeles, CA: University of Southern California; November 16-19, 2000.
173. Jonckheere E, Lohsoonthorn P, Boone W. Dynamic modeling of spinal electromyographic activity during various conditions [Session WA-13-3, Biomedical Applications]. Paper presented at: American Control Conference; June 4-6, 2003; Denver, CO; 2003.
174. Jonckheere E, Lohsoonthorn P, Mahajan V. ChiroSensor: an array of noninvasive sEMG electrodes. Paper presented at: Medicine Meets Virtual Reality. January 26-29, 2005; Long Beach, CA; 2005.
175. Martin-del-Campo R, Jonckheere E. Stationary regime for standing wave Central Pattern Generator. Paper presented at: 3rd IEEE Global SIP 2015: Symposium on Signal Processing and Mathematical Modeling of Biological Processes with Applications to Cyber-Physical Systems for Precise Medicine December 14-16, 2015; Orlando, FL; 2015.
176. Musuvathy S. *Coherently Interacting Dynamics in the Neuromuscular System* [Dissertation]: Electrical Engineering, University of Southern California; 2011.
177. Boone W. Editor's perspective: the journey ahead. *J Vert Sublux Res.* 1998;2(1):1-2.
178. Boone W. The role of vertebral subluxation. *J Vert Sublux Res.* 1999;3(2):55-56.
179. Editor, ed. In Memoriam: William Ralph Boone, Ph.D., D.C. Sherman Shares; 2010;Dec.
180. McGregor-Triano M. *Jurisdictional Control of Conservative Spine Care: Chiropractic Versus Medicine* [dissertation]. Dallas, TX: The University of Texas at Dallas; December 2006.
181. Dobson G, Pistolese R. An impairment rating analysis of asthmatic children under chiropractic care. *J Vert Sublux Res.* 1997;1(4):41-48.
182. Boone W. *The Effect of Low Salinity on Amino Acid Metabolism in the Tissues of the Common Mud Crab, Panopeus Herbstii (Milne-Edwards)* [dissertation]. Columbia, SC: Dissertation, University of South Carolina; 1973.
183. Boone W, Claybrook D. The effect of low salinity on amino acid metabolism in the tissues of the common mud crab, *Panopeus herbstii* (Milne-Edwards). *Comp Biochem Physiol A.* 1977;57(1):99-106.
184. Boone W, Schoffeniels E. Hemocyanin synthesis during hypo-osmotic stress in the shore crab *Carcinus maenas* (L.). *Comp Biochem Physiol B.* 1979;63(2):207-214.
185. Briggs L, Boone W. Effects of a chiropractic adjustment on changes in pupillary diameter: a model for evaluating somatovisceral response. *J Manipulative Physiol Ther.* 1988;11(3):181-189.
186. Waters K, Boone W. The relationship of spinal misalignment elements to muscle imbalance in dance performance. *Chiropractic.* 1988;1(2):49-58.
187. Stewart M, Riffle D, Boone W. Computer-aided pattern analysis of temperature differentials. *J Manipulative Physiol Ther.* 1989;12(5):345-352.
188. Kale M, Keeter T. A mechanical analysis of the side posture and knee-chest specific adjustment techniques. *J Vert Sublux Res.* 1997;1:35-42.
189. Gentempo P, Kent C, Hightower B, Minicozzi S. Normative data for paraspinal surface electromyographic scanning using a 25-500 Hz bandpass. *J Vert Sublux Res.* 1996;1:43-50.
190. Kent C. Surface electromyography in the assessment of changes in paraspinal muscle activity associated with vertebral subluxation. *J Vert Sublux Res.* 1997;1:15-24.
191. Dobson G. Structural changes in the cervical spine following spinal adjustments in a patient with os odontoideum: a case report. *J Vert Sublux Res.* 1996;1(1):1-4.
192. Weber M, Masarsky CS. Cervico-thoracic subluxation and hot flashes in a perimenopausal subject: a time series case report. *J Vert Sublux Res.* 1996;1:33-40.
193. Hart J. Persistence of vertebral misalignments detected on radiographs of the cervical spine during chiropractic care. *J Vert Sublux Res.* 1997;1:49-53.
194. Shaikewitz M. A demographic and physical characterization of cervical spine curvature and degeneration. *J Vert Sublux Res.* 1996;1:41-48.
195. McCoy HG, McCoy M. A multiple parameter assessment of whiplash injury patients undergoing subluxation based chiropractic care: a retrospective study. *J Vert Sublux Res.* 1997;1:51-61.
196. Kessinger R. Changes in pulmonary function associated with upper cervical specific chiropractic care. *J Vert Sublux Res.* 1997;1:43-50.
197. Graham RL, Pistolese RA. An impairment rating analysis of asthmatic children under chiropractic care. *J Vert Sublux Res.* 1997;1(4):1.
198. Schwartzbauer J, Kolber J, Schwartzbauer M, Hart J, Zhang J. Athletic performance and physiological measures in baseball players following upper cervical chiropractic care: a pilot study. *J Vert Sublux Res.* 1997;1:33-40.
199. Morter T, Schuster TL. Changes in salivary pH and general health status following the clinical application of Bio-Energetic synchronization. *J Vert Sublux Res.* 1998;2:35-42.
200. Kessinger R, Boneva D. Changes in visual acuity in patients receiving upper cervical specific chiropractic care. *J Vert Sublux Res.* 1998;2:43-49.
201. Evans JM. Differential compliance measured by the function recording and analysis system in the assessment of vertebral subluxation. *J Vert Sublux Res.* 1998;2:15-22.
202. Miller E, Redmond P. Changes in digital skin temperature, surface electromyography, and electrodermal activity in subjects receiving network spinal analysis care. *J Vert Sublux Res.* 1998;2:1-9.
203. Vanquaethem P, Gould J. The use of a numerical point system in the assessment of clinical progress in patients under subluxation-based chiropractic care: a case study. *J Vert Sublux Res.* 1996;2(2):97.
204. Lee G, Jensen C. Remission of hepatocellular carcinoma in a patient under chiropractic care. *J Vert Sublux Res.* 1998;2:125-130.
205. Evans JM, Collins DL. The clinical application of differential compliance methodology to joint fixation identification and resolution using the PulStarFRAS [TM]. *J Vert Sublux Res.* 1998;2:131-136.
206. Stillwagon G, Stillwagon K. Vertebral subluxation correction and its affect on thermographic readings: a description of the advent of the visi-therm as applied to chiropractic patient assessment. *J Vert Sublux Res.* 1998;1(4):1-2.
207. Kelly S, Boone W. The clinical application of surface electromyography as an objective measure of change in the chiropractic assessment of patient progress: a pilot study. *J Vert Sublux Res.* 1998;2:175-181.
208. Behrendt M. Reduction of psoriasis in a patient under network spinal analysis care: a case report. *J Vert Sublux Res.* 1998;4:1-5.
209. McCoy M. Editor's perspective: what role for chiropractic? 2000;4(1-2).
210. Chirofutures. Our founders. Accessed September 24, 2016.
211. McCoy M. Editor's perspective: research, scholarship & the future of the chiropractic profession. *Ann Vertebral Sublux Res.* 2011;Jan(1-2).

212. Foundation for Vertebral Subluxation: Leadership - Christopher Kent DC, JD, President. Available at: <https://vertebralsubluxation.org/about-us-1>. Accessed November 25, 2018.
213. Sherman. Staff directory: Christopher Kent D.C., J.D. Available at: <https://www.sherman.edu/employees/staff-directory/name/christopher-kent-4/>. Accessed September 24, 2016.
214. Haldeman S, Hammerich K. The evolution of neurology and the concept of chiropractic. *ACA J Chiropr*. August 1973; VII(S-57):60.
215. Watkins RJ. Subluxation terminology since 1746. *J CCA*. Fall 1968. In: Walton S. *The Complete Chiropractor: RJ Watkins, DC, PhC, FICC, DACBR*. Asheville, NC: The Institute Chiropractic; 2017:271-279.
216. Terrett A. The search for the subluxation: an investigation of medical literature to 1985. *Chiropr Hist*. 1987;7(1):29-33.
217. RStephenson R. *Chiropractic Textbook*: Vol. 14. Davenport, IA: Palmer School of Chiropractic; 1927.
218. Lantz C. The vertebral subluxation complex: part 1. *Chiropr Res J*. 1989;1(3).
219. Lantz C. The vertebral subluxation complex: part 2. *Chiropr Res J*. 1990;1(3).
220. Dobson GJ. Curriculum vitae; 2016.
221. Dobson GJ. Manual muscle testing combined with specific head positions and other articular challenges as an assessment of vertebral subluxation: A descriptive paper. *J Vert Subluxation Res*. 1999;3(2):58-64.
222. Haldeman S, Drum D. The compression subluxation. *J Clin Chiropr Arch*. 1971;7:10-21.
223. Peterson A, Watkins RJ, Himes H, College CMC. *Segmental Neuropathy: The First Evidence of Developing Pathology*. Canadian Memorial Chiropractic College; 1965.
224. Senzon S. Chiropractic and energy medicine: a shared history. *J Chiropr Humanit*. 2008;15:27-54.
225. Senzon S. A history of the mental impulse: theoretical construct or scientific reality? *Chiropr Hist*. 2001;21(2):63-76.
226. McAulay B. Rigor in the philosophy of chiropractic: beyond the dismissivism/authoritarian polemic. *J Chiropr Humanit*. 2005;12:16-32.
227. Villanueva-Russell Y. Caught in the crosshairs: identity and cultural authority within chiropractic. *Soc Sci Med*. 2011;72(11):1826-1837.
228. McAulay B. Neo-institutionalization and professional socialization: the medicalization of "regular" chiropractic. *J Straight Chiropr*. 1995;1:1-7.
229. Cohen SP. Sacroiliac joint pain: a comprehensive review of anatomy, diagnosis, and treatment. *Anesth Analg*. 2005;101(5):1440-1453.
230. Harrison DE, Cailliet R, Harrison DD, Troyanovich SJ, Harrison SO. A review of biomechanics of the central nervous system—part III: spinal cord stresses from postural loads and their neurologic effects. *J Manipulative Physiol Ther*. 1999;22(6):399-410.
231. Rome PL. Neurovertebral influence upon the autonomic nervous system: some of the somato-autonomic evidence to date. *Chiropr J Aust*. 2009;39(1):2.
232. Ruch WJ, Ruch BM. An analysis of pubis symphysis misalignment using plain film radiography. *J Manipulative Physiol Ther*. 2005;28(5):330-335.
233. Andrés Ares JD, Roca Amatriain G, Perucho González A, Nieto C, López D. Bloqueo y radiofrecuencia de la articulación sacroilíaca. *Revista Sociedad Española Dolor*. 2012;19(6):335-345.
234. Oakley P. Influence of axial rotation on chiropractic pelvic analysis. *J Manipulative Physiol Ther*. 2007;30(1):78-79.
235. Panchal SJ. Sacroiliac joint injection and radiofrequency denervation. In: Deer TR, Leong MS, Buvanendran A, Gordin V, Kim PS, Panchal SJ, Ray AL, eds. *Comprehensive Treatment of Chronic Pain by Medical, Interventional, and Integrative Approaches*. Springer; 2013:535-542.
236. Seaman D, Winterstein J. Dysafferentation: a novel term to describe the neuropathophysiological effects of joint complex dysfunction. *J Manipulative Physiol Ther*. 1998;21(4):267-280.
237. McDonald W, Durkin K, Pfefer M. How chiropractors think and practice: the survey of North American chiropractors. *Semin Integr Med*. 2004;2(3):92-98.
238. Watkins RJ. Subluxation terminology. *J Am Chiropr Assoc*. 1968;Sept.
239. *Committee on Standardization of Chiropractic Principles*. *ACA J Chiropr*. July 1956:27.
240. Janse J. History of the development of chiropractic concepts: chiropractic terminology. In: Goldstein M, ed. *The Research Status of Spinal Manipulative Therapy: A Workshop Held at the National Institutes of Health, February 2-4, 1975*. Vol. 15. Bethesda, MD: U.S. Department of Health, Education, and Welfare; 1975:25-42.
241. Wright H. Take your choice. *Chiropractor*. 1936;33(11).
242. Palmer BJ. *Precise, Posture-Constant, Spinograph, Comparative Graphs*; Vol. 14. Davenport, IA: Palmer School of Chiropractic; 1938.
243. Lubka B. Prof. A.D. Speransky's research and chiropractic. *Chiropractor*. 1939;35(1):5.
244. Verner J. *The Science of Chiropractic and Its Proper Place in the New Health Era*. Closter, NJ: Venard Press; 1939.
245. Senzon S. Chiropractic and systems science. *Chiropr Dialogues*. 2015;December 25:9-20.
246. Weiant C. *Medicine and Chiropractic*. New York: Chiropractic Institute; 1958.
247. Weiant C. Lessons from Speransky: some specific applications of chiropractic. *J Natl Chiropr*. 1942.
248. Harper W. *Anything Can Cause Anything: A Correlation of Dr. Daniel David Palmer's Principles of Chiropractic*. San Antonio, TX: WD Harper; 1964.
249. Epstein D. Treatment of neuromuscular pain syndromes and its production of and exacerbation of central nervous system pathological dominance. Paper presented at: Network Chiropractic Seminar: Module D - Neuromuscular treatment. April 11-14, 1990; Monterey, CA; 1990.
250. Carter R. Subluxation-the silent killer. *J Can Chiropr Assoc*. 2000;44(1):9.
251. Mirtz T, Morgan L, Wyatt L, Greene L. An epidemiological examination of the subluxation construct using Hill's criteria of causation. *Chiropr Osteopat*. 2009;17(1):1.
252. Perle S. Foundation for anachronistic chiropractic pseudo-religion. *New York State Chiropractic Association Newsletter*; August 2012:11.
253. Reggars J. Chiropractic at the crossroads or are we just going around in circles? *Chiropr Man Ther*. 2011;19(1):1.
254. Korr IM. *The Neurobiologic Mechanisms in Manipulative Therapy*. New York: Plenum Press; 1977.
255. Haldeman S. *Modern Developments in the Principles and Practice of Chiropractic*. New York: Appleton-Century-Crofts; 1980.
256. Keating J. Science and politics and the subluxation. *Am J Chiropr Med*. 1988;1(3):107-110.
257. Keating J. William D. Harper, Jr., MS, DC: anything can cause anything. *J Can Chiropr Assoc*. 2008;52(1):38.
258. Keating J. A brief history of the chiropractic profession. In: Haldeman S, ed. *Principles and Practice of Chiropractic*. New York, NY: McGraw Hill Companies, Inc.; 2005.
259. Sokolova L, Batuev A. A.A. Ukhtomsky and I.P. Pavlov: A controversy or a dialog? *Zhurnal Vysshey Nervnoy Deyatel'nosti im IP Pavlova*. 2000;50(4):581-586.

260. Keating J. Chiropractic: science and antiscience and pseudo-science side by side. *Skeptical Inquirer*. 1997;21(4):37-43.
261. Keating J. Philosophy and science in chiropractic: essential, inseparable and misunderstood. *Eur J Chiropr*. 2001;46:51-60.
262. Keating J. Letter to the editor: Keating comments to Villanueva-Russell. *Chiropr Hist*. 2007;27(1):7-8.
263. Palmer DD. Is chiropractic an experiment? *The Davenport Times*; June 14, 1902.
264. Rehm W. Necrology. *Who's Who in Chiropractic*; 1980. In: *Who's Who in Chiropractic, International*. Dzaman F, ed. Littleton, CO: Who's Who in Chiropractic International Publishing Co.
265. Palmer BJ. *History in the Making*: Vol. 35. Davenport, IA: Palmer College; 1957.
266. Keating J. Early chiropractic education in Oregon. *J Can Chiropr Assoc*. 2002;46(1):39.
267. Palmer DD. Letter to B.J. Palmer; May 4, 1902. In: Faulkner T. *The Chiropractor's Protégé: The Untold Story of Oakley G. Smith's Journey with D.D. Palmer in Chiropractic's Founding Years*. Rock Island, IL: Association for the History of Chiropractic; 2017:103.
268. Waters T. *Chasing D.D.: D.D. Palmer in the News 1886-1913*. Raleigh, NC: Lulu, Inc.; 2013.
269. Waters T. *Fishing for Palmer in What Cheer: D.D. Palmer 1882-1886*. Raleigh, NC: Lulu, Inc.; 2015.
270. Waters T. *Chips from Sweet Home: Writings of D.D. Palmer 1869-1881*. Raleigh, NC: Lulu, Inc.; 2013.
271. Palmer DD. Cured by magnetism. *The Burlington Daily Hawkeye: Sunday Morning*; October 9, 1887.
272. Palmer DD. *Cripples cured! The sick get well by magnetism*. Ed, Borchert, Printer; 1889;June 20.
273. Palmer DD. *The Magnetic Cure*; 1896.
274. Palmer DD. *The chiropractic*, Number 17; January 1897.
275. Faye LJ. *Course Lecture Notes*. Huntington Beach, CA: Motion Palpatation Institute; 1981.
276. Keating J, Nelson J, Mootz R. A model for clinical, scientific and educational development. *Res Forum*. 1986;2(4):103-104.
277. Holt K, Russell D, Cooperstein R, Young M, Sherson M, Haavik H. Inter-examiner reliability of the detection of vertebral subluxation using continuous measures and confidence levels. Paper presented at: International Research and Philosophy Symposium. Oct 10-11, 2015; Spartanburg, SC; 2015.
278. Holt K, Russell D, Hoffmann N, Bruce B, Bushell P, Haavik H. Interexaminer reliability of a leg length analysis procedure among novice and experienced practitioners. *J Manipulative Physiol Ther*. 2009;32(3):216-222.
279. Holt K, Russell D, Cooperstein R, Young M, Sherson M, Haavik H. Inter-examiner reliability of the detection of vertebral subluxation using continuous measures and confidence levels. Paper presented at: ACC-RAC 2016: Best Practices. March 16-17, 2016; Orlando, FL; 2016.
280. Cooperstein R, Young M, Haneline M. Interexaminer reliability of cervical motion palpation using continuous measures and rater confidence levels. *J Can Chiropr Assoc*. 2013;57(2):156-164.
281. Cooperstein R, Haneline M, Young M. Interexaminer reliability of thoracic motion palpation using confidence ratings and continuous analysis. *J Chiropr Med*. 2010;9(3):99-106.